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Appointed November 4, 1881.

REPORT

ON

COTTON PRODUCTION IN THE UNITED STATES;

107783

ALSO EMBRACING

AGRICULTURAL AND PHYSICO-GEOGRAPHICAL DESCRIPTIONS

OF THE

SEVERAL COTTON STATES AND OF CALIFORNIA.

EUGENE W. HILGARD, Ph. D.,

Professor of Agriculture, University of California, former Professor at the University of Mississippi, and State Geologist,

SPECIAL AGENT IN CHARGE.

PART II.

EASTERN GULF, ATLANTIC, AND PACIFIC STATES.

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SUBJECTS OF THIS REPORT.

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GENERAL DISCUSSION OF COTTON PRODUCTION ..... By EUGENE W. HILGARD.

COTTON PRODUCTION IN THE MISSISSIPPI VALLEY AND SOUTHWESTERN STATES.

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MISSISSIPPI .....
TENNESSEE AND KENTUCKY ..... By JAMES M. SAFFORD.
MISSOURI ..... By R. H. LOUGHRIDGE.
ARKANSAS .....
TEXAS .....
INDIAN TERRITORY .....

PART II.

COTTON PRODUCTION IN THE EASTERN GULF, ATLANTIC, AND PACIFIC STATES.

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REPORT

ON THE

COTTON PRODUCTION OF THE STATE OF ALABAMA,

WITH A DISCUSSION OF

THE GENERAL AGRICULTURAL FEATURES OF THE STATE.

BY

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STATE GEOLOGIST AND PROFESSOR OF CHEMISTRY AND GEOLOGY AT THE UNIVERSITY OF ALABAMA,

AND

SPECIAL CENSUS AGENT.

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LETTERS OF TRANSMITTAL.

BERKELEY, CALIFORNIA, *September* 12, 1882.

To the SUPERINTENDENT OF CENSUS.

DEAR SIR: I transmit herewith a report on the cotton production and agricultural features of the state of Alabama, by Dr. Eugene Allen Smith, professor of chemistry and geology at the University of Alabama, and state geologist. In so doing, permit me to say that I consider Dr. Smith's report to be one of the best digested and most complete of the series of which it forms a part. The geology of Alabama is by far the most complex among the cotton-growing states, its formations ranging from the very base of the stratified rocks to the most modern, with a very varied representation of each of the several ages. This variety has in a great measure impressed itself upon the surface features and soils of the state, the consequence being that it is hardly possible to discuss the latter intelligently without frequent reference to the geological features. Hence the prominence necessarily given to the latter in the descriptions of the several regions.

The painstaking thoroughness of Dr. Smith's work will need no comment with the readers of this as well as other reports issued from his pen; but the amount of labor involved therein can hardly be appreciated save by those familiar with such work and with the extreme complexity of the natural features of the state.

Very respectfully,

E. W. HILGARD,
Special Agent in charge of Cotton Production.

UNIVERSITY OF ALABAMA,
Tuscaloosa, Alabama, August 1, 1882.

Dr. EUGENE W. HILGARD,
Special Census Agent in charge of Cotton Production.

DEAR SIR: With this I transmit my report on the cotton production of the state of Alabama. In the arrangement of the subject-matter I have followed the plan adopted by yourself in the report already published on the cotton production of the state of Louisiana.

The principal sources of information used in the preparation of the present report have been:

The geological reports of Professor M. Tuomey, published in the years 1850 and 1858, respectively.

The reports of progress of the geological survey, made by myself, for the years 1874, 1875, 1876, 1877–'78, and 1879–'80.

Manuscript notes of several excursions made by me, under the auspices of the Census Office, for the purpose of collecting soil specimens and certain data for this report.

The answers returned by correspondents from the various counties to whom were sent the schedules of questions relating to cotton culture.

From *Dr. Charles Mohr*, of Mobile, a special agent of the Census Office, I have received many valuable notes on the botanical character of the different parts of the state.

The county officers in many parts of the state have given, upon solicitation, much information regarding their own sections.

More than half of the analyses of soils and subsoils given have been made at the expense of the state geological survey, and acknowledgments are due also to Messrs. McCalley, Cory, Durrett, and Langdon, students in the chemical laboratory of the University of Alabama (employed also by the Census Office and by the state survey), for analyses made by them without charge.

Finally, free use has been made of the published bulletins of the Census Office.

The details of the arrangement of the matter of this report are as follows:

The tabulated results of the enumeration relating to area, population, and cotton production, and to the production of the leading crops.

Part I. A general account of the physical and geological features of the state.

A special description of the agricultural subdivisions or regions, accompanied by analyses of the most characteristic soils and discussions of the analyses. The soils analyzed were collected by myself, except those otherwise specially credited.

Next follows a list of the botanical and common names of the characteristic timber trees and other plants of the several regions, including those giving most trouble to farmers, as weeds.

Part I concludes with some remarks on cotton culture in the state, in which the statistics are presented in tabular form, to show the relations of the several regions in respect of area, population, and cotton production, and to compare these regions, as regards their product per acre and their respective contributions, to the total production of the state. Under each region are also given the "banner" counties in regard to the product per acre and total production, and a general discussion of the areas of greatest production, of the relations between the population and cotton production, the part borne by the two races (black and white) in cotton production, with some inferences drawn concerning the effect on the soil and on the yield of the prevalent systems of farming. This is followed by a chapter on the use of fertilizers in cotton planting, and an account of the materials naturally occurring in Alabama, which have been, or which may hereafter be, used in the improvement of the soils.

Part II is devoted to the agricultural descriptions of the counties of the state, grouped under the several agricultural regions described in Part I. When a county belongs to more than one of these divisions, it is described in connection with that region with which it is thought to have most in common.

Each county description is preceded by a heading giving data relating to population, area, lands in cultivation, with the proportion devoted to each of the leading crops, but particularly to cotton, under which head are given the number of bales, the average product per acre, and the percentage of tilled land in cotton.

The statements of areas are based upon measurements which have been made as accurately as possible, but they are to be considered only as approximations, since the lines separating the several agricultural regions are themselves to a certain extent conventional.

In the county descriptions abstracts are given of the answers to the schedule questions relating to the soil varieties, their yield of seed-cotton when fresh, the most troublesome weeds, prevalent practice with regard to protection against injury from washes, etc.

The great discrepancy between the estimates of correspondents and the enumeration returns regarding the average yield of the soils is more particularly noticed in the section devoted to remarks on cotton culture.

Part III is devoted to the details relating to culture, system of farming, etc., being an abstract (condensed, but containing all the essential material) of the answers to the schedule questions relating to tillage and improvement of land, planting and cultivation of cotton, ginning, baling, and shipping of the same, diseases and insect enemies, etc., and to labor and system of farming.

Very respectfully,

10

EUGENE A. SMITH.

TABULATED RESULTS OF THE ENUMERATION.

TABLE I.—AREA, POPULATION, TILLED LAND, AND COTTON PRODUCTION.
TABLE II.—ACREAGE AND PRODUCTION OF LEADING CROPS.

No. 3
ANN ARBOR, MICH.

TABULATED RESULTS OF THE ENUMERATION.

TABLE I.—AREA, POPULATION, TILLED LAND, AND COTTON PRODUCTION.

Counties.	Area (square miles).	POPULATION.						TILLED LAND.		COTTON PRODUCTION.							
		Total.	Male.	Female.	White.	Color'd.	Per square mile.	Acres.	Percentage of area.	Percentage of tilled lands in cotton.	Acres.	Bales.	Average per acre.			Cotton acreage per square mile.	Bales per square mile.
													Bale.	Seed-cotton.	Lint.		
The State	51,540	1,262,505	622,629	639,876	662,185	600,320	24	6,134,198	19	38	2,330,086	699,654	0.30	429	143	45	14
METAMORPHIC REGION.																	
Cleburne	540	10,976	5,356	5,620	10,308	668	20	51,428	15	18	9,156	3,600	0.39	555	185	17	7
Randolph	610	16,575	8,198	8,377	13,155	3,420	27	81,426	21	28	23,177	7,475	0.32	456	152	38	12
Chambers	610	23,440	11,517	11,923	11,364	12,076	38	149,283	38	48	70,934	19,476	0.27	384	128	116	32
Lee	610	27,262	13,079	14,183	12,217	15,045	45	122,875	31	42	51,889	13,189	0.25	357	119	85	22
Tallapoosa	810	23,401	11,578	11,823	16,108	7,293	29	143,175	28	29	41,200	14,161	0.34	486	162	51	17
Clay	610	12,938	6,330	6,608	11,870	1,068	21	57,972	15	24	13,921	4,973	0.36	513	171	23	8
Coosa	670	15,113	7,500	7,613	10,050	5,063	23	80,791	19	33	26,468	8,411	0.32	456	152	40	13
Total	4,460	129,705	63,558	66,147	85,072	44,638	29	686,950	24	34	236,745	71,285	0.30	429	143	53	16
COOSA VALLEY REGION.																	
Cherokee	660	19,108	9,679	9,429	16,418	2,690	29	88,819	21	27	24,388	10,777	0.44	627	209	37	16
Calhoun	640	19,591	9,836	9,755	14,134	5,457	31	93,857	23	28	26,435	10,848	0.41	585	195	41	17
Etowah	520	15,398	7,703	7,695	12,896	2,502	30	60,780	18	25	15,187	6,571	0.43	612	204	29	13
Saint Clair	630	14,462	7,231	7,231	11,621	2,841	23	65,105	16	23	14,735	6,028	0.41	585	195	23	10
Talladega	700	23,360	11,380	11,980	10,856	12,504	33	113,389	25	29	32,841	11,832	0.36	513	171	47	17
Shelby	780	17,236	8,664	8,572	12,253	4,983	22	58,550	12	31	17,919	6,643	0.37	528	176	23	9
Total	3,930	109,155	54,493	54,662	78,178	30,977	28	480,500	19	27	131,505	52,699	0.40	570	190	33	13
COAL-MEASURES REGION.																	
De Kalb	740	12,675	6,300	6,375	11,993	682	17	52,096	11	14	7,469	2,859	0.38	543	181	10	4
Marshall	560	14,585	7,208	7,377	13,084	1,501	26	68,175	19	24	16,412	5,858	0.33	471	157	29	10
Cullman	590	6,355	3,234	3,121	6,312	43	11	20,527	5	7	1,469	878	0.26	372	124	2	1
Blount	700	15,369	7,644	7,725	14,210	1,159	22	68,860	15	18	12,502	4,442	0.36	513	171	18	6
Jefferson	960	23,272	11,896	11,376	18,219	5,053	24	71,959	12	20	14,220	5,333	0.38	543	181	15	6
Walker	880	9,479	4,633	4,846	8,978	501	11	46,725	8	19	8,743	2,754	0.31	441	147	10	3
Winston	640	4,253	2,131	2,122	4,236	17	7	17,767	4	12	2,048	568	0.28	399	133	3	1
Total	5,070	85,988	43,046	42,942	77,032	8,956	17	346,109	11	18	62,863	21,692	0.35	498	166	12	4
TENNESSEE VALLEY REGION.																	
Jackson	990	25,114	12,626	12,488	21,074	4,040	25	123,924	20	16	19,685	6,235	0.32	456	152	20	6
Morgan	700	16,428	8,185	8,243	11,758	4,670	23	95,584	21	20	18,828	6,133	0.33	471	157	27	9
Madison	810	37,625	18,538	19,087	18,591	19,034	46	213,221	41	34	72,838	20,679	0.28	399	133	90	26
Limestone	590	21,600	10,762	10,838	11,637	9,963	37	129,477	34	34	44,334	15,724	0.35	498	163	75	27
Lauderdale	700	21,035	10,485	10,550	14,173	6,862	30	102,839	23	26	26,594	9,270	0.35	498	166	38	13
Lawrence	790	21,392	10,620	10,772	12,642	8,750	27	138,034	27	31	42,803	13,791	0.32	456	152	54	17
Colbert	570	16,153	7,980	8,173	9,203	6,950	28	74,876	21	34	25,411	9,012	0.35	498	166	45	16
Franklin	610	9,155	4,523	4,632	8,079	1,076	15	46,895	12	22	10,368	3,603	0.35	498	166	17	6
Total	5,760	168,502	83,719	84,783	107,157	61,345	29	924,850	25	28	260,861	84,447	0.32	456	152	45	15
OAK AND HICKORY UPLANDS, WITH SHORT-LEAF PINE.																	
Marion	810	9,364	4,599	4,765	8,841	523	12	42,925	8	17	7,269	2,240	0.31	441	147	9	3
Lamar	590	12,142	5,992	6,150	9,967	2,175	21	62,141	16	25	15,245	5,015	0.33	471	157	26	8
Fayette	660	10,135	5,061	5,074	8,873	1,262	15	56,118	13	22	12,331	4,268	0.35	498	166	19	6
Pickens	1,000	21,479	10,605	10,874	9,132	12,347	21	115,560	18	46	52,651	17,283	0.33	471	157	53	17
Total	3,060	53,120	26,257	26,863	36,813	16,307	17	276,744	14	32	87,496	28,806	0.33	471	157	29	9
GRAVELLY HILLS, WITH LONG-LEAF PINE.																	
Tuscaloosa	1,390	24,957	12,104	12,853	15,216	9,741	18	111,171	12	30	33,773	11,137	0.33	471	157	24	8
Bibb	610	9,487	4,664	4,823	5,887	3,600	16	43,796	11	36	15,737	4,843	0.31	441	147	26	8
Chilton	700	10,793	5,418	5,375	8,651	2,142	15	40,676	9	28	11,558	3,534	0.31	441	147	17	5
Autauga	660	12,108	6,451	6,657	4,397	8,711	20	81,388	19	37	30,474	7,944	0.26	372	124	46	12
Elmore	630	17,502	8,780	8,722	8,747	8,755	28	73,897	18	42	31,045	9,771	0.31	441	147	49	16
Total	3,990	75,847	37,417	38,430	42,898	32,949	19	350,928	14	35	122,587	37,229	0.30	429	143	31	9

TABLE I.—AREA, POPULATION, TILLED LAND, AND COTTON PRODUCTION—Continued.

Counties.	Area (square miles).	POPULATION.						TILLED LAND.		COTTON PRODUCTION.							
		Total.	Male.	Female.	White.	Color'd.	Per square mile.	Acres.	Percentage of area.	Percentage of tilled lands in cotton.	Acres.	Bales.	Average per acre.			Cotton acreage per square mile.	Bales per square mile.
													Bale.	Seed-cotton.	Lint.		
OAK AND HICKORY UPLANDS, WITH LONG-LEAF PINE.																	
Choctaw	930	15,731	7,750	7,981	7,390	8,341	17	77,188	13	40	31,086	9,054	0.29	414	138	33	10
Clarke	1,160	17,806	8,797	9,009	7,718	10,088	15	77,186	10	43	33,477	11,097	0.33	471	157	29	10
Monroe	1,030	17,091	8,344	8,747	7,780	9,311	17	77,317	12	43	33,463	10,421	0.31	441	147	32	10
Wilcox	960	31,828	15,624	16,204	6,711	25,117	33	161,228	26	48	77,076	26,745	0.35	498	166	80	28
Butler	800	19,649	9,483	10,166	10,684	8,965	25	87,010	17	41	35,851	11,895	0.33	471	157	45	15
Conecuh	840	12,605	6,257	6,348	6,224	6,381	15	46,965	9	35	16,523	4,633	0.28	399	133	20	6
Crenshaw	660	11,726	5,741	5,985	9,118	2,608	18	67,770	16	40	26,962	8,173	0.30	429	143	41	12
Pike	740	20,640	10,157	10,483	14,368	6,272	28	114,850	24	41	47,107	15,136	0.32	456	152	64	20
Coffee	700	8,119	4,025	4,094	6,831	1,288	12	42,126	9	39	16,431	4,788	0.29	414	138	23	7
Dale	650	12,677	6,174	6,503	10,553	2,124	20	68,413	16	40	27,076	6,224	0.23	327	109	42	10
Henry	1,000	18,761	9,251	9,510	11,994	6,767	19	137,348	21	40	54,305	12,573	0.23	327	109	54	13
Total	9,470	186,633	91,603	95,030	99,371	87,262	20	957,395	16	42	399,357	120,739	0.30	429	143	42	13
CENTRAL PRAIRIE REGION.																	
Sumter	1,000	28,728	13,982	14,746	6,451	22,277	29	172,100	27	47	80,662	22,211	0.28	399	133	81	22
Greene	520	21,931	10,823	11,108	3,765	18,166	42	119,426	36	53	63,643	15,811	0.25	357	119	122	30
Hale	670	26,553	13,196	13,357	4,903	21,650	40	140,072	33	50	69,995	18,093	0.26	372	124	104	27
Marengo	960	30,890	15,139	15,751	7,277	23,613	32	169,097	28	48	80,790	23,481	0.29	414	138	84	24
Perry	790	30,741	15,050	15,691	7,150	23,591	39	167,666	33	44	74,303	21,627	0.29	414	138	94	27
Dallas	980	48,433	23,824	24,609	8,425	40,008	49	207,404	33	56	115,631	33,534	0.29	414	138	118	34
Lowndes	740	31,176	15,552	15,624	5,645	25,531	42	181,272	38	54	98,200	29,356	0.30	429	143	133	40
Montgomery	740	52,356	25,563	26,793	13,457	38,899	71	240,570	51	46	112,125	31,732	0.28	399	133	152	43
Bullock	660	29,066	14,345	14,721	6,944	22,122	44	176,860	42	45	80,470	22,578	0.28	399	133	122	34
Macon	630	17,371	8,434	8,937	4,587	12,784	28	133,924	33	42	56,763	14,580	0.26	372	124	90	23
Russell	670	24,887	12,109	12,728	6,182	18,655	37	134,320	31	61	81,582	19,442	0.24	342	114	122	29
Barbour	860	33,979	16,774	17,205	13,091	20,888	40	197,455	36	51	100,442	26,063	0.26	372	124	117	30
Total	9,220	376,061	184,791	191,270	87,877	288,184	41	2,041,166	35	50	1,014,606	278,508	0.27	384	128	110	30
LONG-LEAF PINE REGION.																	
Washington	1,050	4,538	2,341	2,197	2,807	1,731	4	8,936	1	37	3,280	1,246	0.38	543	181	3	1
Mobile	1,290	48,653	23,086	25,567	27,187	21,466	38	8,998	1	.....	1	1	.....	.....	.....	.....	.....
Baldwin	1,620	8,603	4,430	4,173	4,890	3,713	5	7,698	1	18	1,384	638	0.46	657	219	1	.....
Escambia	1,000	5,719	2,933	2,786	4,106	1,613	6	6,934	1	4	278	94	0.34	486	162	.....	.....
Covington	1,030	5,639	2,757	2,882	4,968	671	5	19,326	3	22	4,176	1,158	0.28	399	133	4	1
Geneva	590	4,342	2,198	2,144	3,829	513	7	17,664	5	28	4,947	1,112	0.23	327	109	8	2
Total	6,580	77,494	37,745	39,749	47,787	29,707	12	69,556	2	20	14,066	4,249	0.30	429	143	2	1

TABLE II.—ACREAGE AND PRODUCTION OF LEADING CROPS.

Counties.	COTTON.		INDIAN CORN.		OATS.		WHEAT.		TOBACCO.		SWEET POTATOES.	
	Acres.	Bales.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Pounds.	Acres.	Bushels.
Total for the State	2,330,086	609,654	2,055,929	25,451,278	324,628	3,039,639	264,971	1,529,657	2,197	452,426	43,256	3,448,819
METAMORPHIC REGION.												
Cleburne	9,156	3,600	21,552	362,335	5,672	58,084	7,504	48,904	85	15,113	221	25,246
Randolph	23,177	7,475	29,595	332,466	4,850	43,558	10,155	58,879	44	11,521	433	36,873
Chambers	70,934	19,476	49,306	458,286	9,258	80,592	11,520	75,945	39	8,055	1,038	83,116
Lee	51,889	13,189	30,137	244,903	11,918	101,911	8,697	50,225	11	1,766	925	79,011
Tallapoosa	41,200	14,161	41,415	461,960	9,106	78,684	14,572	99,061	21	5,350	408	40,308
Clay	13,921	4,973	24,503	292,870	4,834	39,308	9,785	54,603	85	13,468	237	28,120
Coosa	26,468	8,411	29,990	364,399	5,225	41,758	9,735	55,028	28	5,258	412	33,268
Total	236,745	71,285	226,498	2,517,219	50,963	443,895	71,968	442,145	313	60,531	3,674	316,942
COOSA VALLEY REGION.												
Cherokee	24,388	10,777	33,373	509,381	7,477	66,215	10,085	66,956	82	14,318	335	20,765
Calhoun	26,435	10,848	33,714	469,598	8,852	93,368	10,745	67,660	29	6,592	283	27,876
Etowah	15,187	6,571	24,801	382,788	5,075	44,734	7,063	40,192	47	11,333	280	19,631
Saint Clair	14,735	6,028	25,465	341,703	4,603	41,291	9,841	54,853	53	11,208	226	22,187
Talladega	32,841	11,832	40,376	454,873	9,278	92,356	13,233	89,868	30	5,520	335	22,872
Shelby	17,019	6,643	26,159	312,839	4,764	39,318	6,294	34,324	10	2,298	346	30,654
Total	131,505	52,699	183,978	2,471,182	39,999	377,312	57,261	353,853	251	51,269	1,755	143,985
COAL-MEASURES REGION.												
De Kalb	7,469	2,859	23,929	322,259	5,113	34,843	6,846	37,382	19	4,322	218	14,778
Marshall	10,412	5,358	27,113	465,582	3,471	31,873	5,797	30,984	48	9,719	243	17,815
Cullman	1,469	378	10,343	102,982	1,179	8,198	2,569	12,452	41	8,888	215	11,006
Blount	12,502	4,442	29,161	422,048	4,551	44,194	10,087	60,856	48	9,912	371	22,265
Jefferson	14,220	5,333	30,928	429,660	4,708	43,414	10,589	60,038	55	17,649	504	44,091
Walker	8,743	2,754	21,838	263,123	2,579	21,687	5,420	26,149	69	10,900	325	21,579
Winston	2,048	568	8,098	88,781	579	4,043	1,967	8,314	3	571	172	9,912
Total	62,863	21,692	151,410	2,094,435	22,180	188,252	43,275	236,175	283	61,961	2,048	141,441
TENNESSEE VALLEY REGION.												
Jackson	19,685	6,235	60,285	1,090,486	8,241	90,962	10,051	58,335	99	17,127	592	32,538
Morgan	18,828	6,133	35,610	580,687	4,704	40,533	7,005	39,820	52	17,795	365	26,745
Madison	72,838	20,679	69,246	1,033,223	6,877	81,161	12,578	80,716	224	36,356	839	36,577
Limestone	44,334	15,724	44,612	719,928	4,134	40,389	7,561	41,638	107	32,034	417	26,746
Lauderdale	26,594	9,270	42,890	721,039	4,609	39,233	8,475	36,376	105	19,870	467	34,105
Lawrence	42,863	13,791	54,643	798,931	5,691	56,352	5,919	34,024	105	27,276	379	29,095
Colbert	25,411	9,012	31,575	500,701	3,846	43,914	1,704	10,923	34	8,626	286	16,126
Franklin	10,368	3,603	21,038	348,897	3,020	23,143	1,660	7,331	17	3,087	137	10,159
Total	260,861	84,447	359,899	5,802,892	41,122	415,687	54,953	309,172	743	162,171	3,482	212,091
OAK AND HICKORY UPLANDS, WITH SHORT-LEAF PINE.												
Marion	7,269	2,240	21,835	272,481	2,321	15,650	3,925	15,136	44	8,285	477	34,261
Lamar	15,245	5,015	28,303	352,474	4,139	32,440	5,627	24,221	46	10,420	626	48,056
Fayette	12,331	4,268	24,950	342,520	3,627	27,302	4,826	22,745	37	7,184	421	32,547
Pickens	52,651	17,283	43,104	491,436	8,053	76,044	2,220	11,985	51	8,637	757	71,223
Total	87,496	28,806	118,192	1,458,911	18,140	151,466	16,598	74,087	178	34,526	2,281	186,087
GRAVELLY HILLS, WITH LONG-LEAF PINE.												
Tuscaloosa	33,773	11,137	38,638	489,784	6,974	63,013	2,689	12,388	20	5,568	919	86,036
Bibb	15,737	4,843	18,816	236,086	2,935	21,926	3,125	16,700	36	5,248	368	36,892
Chilton	11,558	3,534	18,185	183,975	2,255	18,300	4,507	20,661	4	537	356	34,427
Autauga	30,474	7,044	20,417	184,393	2,153	22,044	700	3,459	8	1,844	540	34,820
Elmore	31,045	9,771	20,000	211,688	5,153	49,849	3,883	20,779	12	2,585	642	49,260
Total	122,587	37,229	116,056	1,305,926	19,470	175,132	14,904	73,987	80	15,782	2,825	241,435

TABLE II.—ACREAGE AND PRODUCTION OF LEADING CROPS—Continued.

Counties.	COTTON.		INDIAN CORN.		OATS.		WHEAT.		TOBACCO.		SWEET POTATOES.	
	Acres.	Bales.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Pounds.	Acres.	Bushels.
OAK AND HICKORY UPLANDS, WITH LONG-LEAF PINE.												
Choctaw	31,086	9,054	25,613	272,213	3,338	28,432	.....	.....	23	4,322	748	65,545
Clarke	33,477	11,097	28,220	312,718	5,065	47,737	7	30	19	2,349	1,256	95,247
Monroe	33,463	10,421	24,135	251,068	4,597	44,024	.....	.....	11	2,496	920	81,893
Wilcox	77,076	26,745	40,053	573,385	7,011	92,933	22	179	15	2,695	1,597	130,591
Butler	35,851	11,895	24,648	274,668	7,494	71,100	10	150	7	2,559	679	67,606
Conecuh	16,523	4,633	20,118	181,277	3,173	25,136	.....	.....	7	1,210	652	54,536
Crenshaw	26,962	8,173	28,099	254,950	5,208	36,480	26	139	33	6,256	558	52,218
Pike	47,107	15,136	42,207	374,170	5,424	38,698	72	408	5	764	883	91,680
Coffee	16,431	4,788	18,668	155,014	2,370	15,025	22	85	5	1,403	474	48,272
Dale	27,076	6,224	31,867	221,497	5,114	28,894	59	336	2	259	872	82,286
Henry	54,305	12,573	48,661	325,846	7,992	63,402	193	906	24	4,499	1,266	112,684
Total	399,357	120,739	332,289	3,196,806	56,696	491,861	411	2,233	151	28,803	9,905	882,558
CENTRAL PRAIRIE REGION.												
Sumter	80,662	22,211	51,402	699,883	2,706	31,380	24	225	13	2,627	1,056	96,402
Greene	63,643	15,811	31,826	402,992	2,163	22,464	314	1,803	41	6,829	705	64,074
Hale	69,995	18,093	43,254	595,185	3,671	45,075	1,437	15,273	16	5,540	1,214	77,830
Marengo	80,790	23,481	43,876	698,009	6,574	83,234	.....	.....	43	7,479	1,138	95,625
Perry	74,303	21,627	48,132	628,248	6,093	63,710	440	2,974	24	4,522	1,107	77,660
Dallas	115,631	33,534	46,542	707,139	8,260	111,213	71	487	13	1,678	2,256	137,387
Lowndes	98,280	29,356	41,169	611,184	3,630	43,922	.....	.....	.....	.....	1,004	68,587
Montgomery	112,125	31,732	62,303	767,427	4,895	62,292	58	393	2	318	1,720	117,285
Bullock	80,470	22,578	47,441	379,876	6,177	43,028	111	455	3	833	773	67,668
Macon	56,763	14,580	23,833	173,969	6,195	53,336	1,916	9,094	6	680	928	60,374
Russell	81,582	19,442	34,335	215,555	9,789	91,141	1,099	6,771	2	303	1,093	80,561
Barbour	100,442	26,063	61,822	437,415	10,264	99,295	181	530	22	3,512	1,274	112,374
Total	1,014,606	278,508	535,935	6,316,882	70,417	750,090	5,601	38,005	185	34,321	14,268	1,054,870
LONG-LEAF PINE REGION.												
Washington	3,280	1,246	4,259	58,105	464	3,547	.....	.....	.....	.....	448	40,095
Mobile	1	1	1,639	25,272	139	1,440	.....	.....	.....	.....	776	58,695
Baldwin	1,384	638	2,041	28,428	350	5,108	.....	.....	1	350	484	50,025
Escambia	278	94	3,699	34,336	869	8,979	.....	.....	.....	.....	494	42,013
Covington	4,176	1,158	10,558	81,997	2,114	16,266	.....	.....	8	1,764	466	42,890
Geneva	4,947	1,112	9,476	58,887	1,705	10,604	.....	.....	4	948	350	33,492
Total	14,066	4,249	31,672	287,025	5,641	45,944	.....	.....	13	3,062	3,018	268,810

PART I.

PHYSICO-GEOGRAPHICAL AND AGRICULTURAL FEATURES

OF THE

STATE OF ALABAMA.

7
17

AGRICULTURAL MAP OF ALABAMA

COMPILED FROM PUBLISHED REPORTS AND MS. NOTES

BY

EUGENE A. SMITH, PH.D.

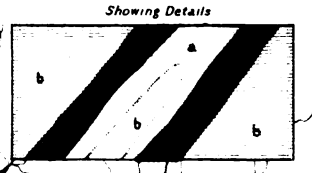
SPECIAL AGENT

1880.

LEGEND

- Red Clay Lands — a. Metamorphic Region; b. South[ern] Ala[ba]ma & L.L. Pine
- Gray Gneissic Lands
- Granitic Lands
- Calcareous Shale & Red Valley Lands, Coosa Valley
- Central Ala: a. Red Lands Tennessee Valley; b. . . . of Narrow Valleys of Coosa Val Region; c. Dunmennets Ridge and Hill Prairies; d. Blue Marl Lands
- Red Ore Ridges
- a. Brown Loam Valley Land and Cherty Ridge Lands based on Magnesian Limestone
- b. Outlying Areas of Long Leaf Pine, & Coal Fields and Coosa River Valley
- c. Long Leaf Pine Hills in S.W. Ala
- a. Sandy Lands of Mountains Coosa Valley Region
- b. . . . Table Lands & Coal Fields
- c. . . . Little Mountain, Tennessee Val
- a. Cherty Lands or Barrens, Tennessee Valley
- b. Gravelly Hills with Long Leaf Pine
- Oak and Hickory Uplands with Short Leaf Pine
- Central Prairie Region, Black Belt
- Flatwoods — a. Based on Metamorphic Slates; b. . . . Calcareous Shales, Coosa V; c. . . . Lignitic Tertiary Clays
- Lower Prairie Region — a. Lime Hills; b. Red Lime Lands
- Oak and Hickory Uplands with Long Leaf Pine
- Open Rolling Pine Woods and Limestone Region
- Pine Flats
- Alluvial of Mobile River

SECTION OF ANTICLINAL VALLEY, ENLARGED, Showing Details



Scale

0 25 50 75 100 MILES

Julius Bien & Co. lith

GENERAL DESCRIPTION OF THE STATE OF ALABAMA.

Alabama is situated between the eighty-fifth and eighty-ninth degrees of west longitude and the thirty-first and thirty-fifth parallels of north latitude. The thirty-fifth parallel makes the northern boundary of the state, and the thirty-first the southern, with the exception of that portion west of the Perdido river, which extends south to the Gulf of Mexico. The form is thus seen to be oblong, with the greater dimension from north to south. The total area thus included is, according to the latest estimates, 52,250 square miles, and the total land surface, 51,540 square miles.

SURFACE CONTOUR.—Leaving out of account the minor irregularities, the surface of the state may be considered as an undulating plain, whose mean elevation above sea-level cannot be much less than 600 feet. Toward the north and east the surface rises above this level, and toward the south and west it sinks below it. The arc of a circle, with Chattanooga as a center, described from the northwestern corner of the state around to the Chattahoochee river at Columbus, would include the area whose general elevation is above 600 feet. The axis of this elevation, which is the southern terminus of the great Appalachian mountain chain, runs northeast and southwest, and the altitude increases toward the northeast. There is thus a general slope away from this elevated region toward all points of the compass from southeast around to northwest. The mountains of the state rest upon this high land, and often reach an elevation above it of 1,200 or 1,500 feet, or above sea-level of 2,000 or 2,500 feet.

The rest of the state outside of the area above mentioned, and whose general altitude is less than 600 feet, has a slope south and southwest toward the Gulf of Mexico and the Mississippi valley. Along this slope the streams have excavated their channels and produced the various topographical features, none of which are due to elevation above the general surface.

RIVER SYSTEMS.—There are, in the most general terms, two things which have determined the drainage system of Alabama. These are, first, the slopes toward the northwest and the southeast, away from the axis of elevation above spoken of; and, second, the more general slope of the surface of the state, taken as a whole, southwest toward the axis of the Mississippi valley. An inspection of the map will show that the latter cause has greatly outweighed the former in fixing the direction of the water-courses, with the result of giving a general southwest direction to the whole drainage system of the state, with the single exception of that of the Tennessee river. In the northeastern part of the state the northeast and southwest direction of the valleys and ridges has also been largely instrumental in turning southwestward (down the valleys) the waters whose natural fall is southeastward at right angles to the axis of elevation of this mountainous region.

Tennessee river.—Looking beyond the limits of the state northeastwardly, we find the Blue Ridge, of which the elevated country in Alabama is but a part, acting as a water-shed between the Atlantic ocean and the Gulf of Mexico. The drainage slopes are therefore toward the northwest and the southeast. At the northwestern foot of this water-shed, in North Carolina, are the headwaters of the Tennessee river. Its natural northwesterly flow is interfered with by the topographical features of the country, the most formidable of which, according to Professor Safford, is the great Cumberland table-land. Parallel with this the river flows through a large part of Tennessee, and, cutting through a detached part of the Cumberland range at Chattanooga, enters the Sequatchie valley, which it follows to Guntersville, in Alabama, where it cuts through the rest of the Cumberland range, and flows thence down the northwesterly slope to its confluence with the Mississippi river. The Tennessee is thus exceptional among the rivers of Alabama.

The Chattahoochee.—This is a boundary stream, and is but slightly related to Alabama, as its headwaters are principally in Georgia. Its tributary streams on the Alabama side are mostly short and insignificant.

The Tallapoosa, Coosa, Alabama, Warrior, and Lower Tombigbee rivers have many things in common. They all have their headwaters in the elevated region above alluded to, and all flow south and southwest into the Gulf of Mexico. In their upper parts, with the exception of the Tombigbee, their flow is alternately southwest down

one of the valleys spoken of, and then south across a ridge to resume their southwestern courses. Where they leave that elevated region (which is in general formed of the tough and hard rocks of the older formations) and pass into the territory formed by the newer and softer rocks there appear the cascades which form the first obstructions to navigation. These falls, or rapids, are seen at Columbus (Georgia), Tallahassee, Wetumpka, Centerville, Tuscaloosa, and Muscle Shoals, on the principal rivers, and at corresponding localities on the smaller streams.

The Coosa river, from Rome, Georgia, down to Greensport, Alabama, flows in general along the strike of the rocks and has no serious obstructions. Below Greensport it turns across these rocks, and rapids are formed, which alternate with stretches of open, smooth waters down to Wetumpka, where the last falls are situated. This river has thus two navigable sections separated by nearly 200 miles of alternating cascades and pools. None of the other rivers in this part of the state are navigable above the lower falls.

The Choctawhatchie and Conecuh rivers, with their tributaries, Pea river, Patsaliga, Sepulga, etc., are all turned southward by a prominent topographical feature known as Chunnenugga ridge, which divides the waters flowing northwestward into the Tallapoosa and Alabama rivers from those flowing southward by various channels into the Gulf. It will be seen that their general direction is west of south, as determined by the general slope of the lower portion of the state.

MOUNTAINS AND TABLE-LANDS.—The mountainous region of the state is confined to the northeastern quarter, as before defined, and the higher portions lie in the eastern half of this area. The valley of the Coosa, from the state line down to the southern line of Shelby and Talladega counties, divides this region into parts which have very different characters. Southeast of this valley are some of the highest lands of the state, and the height of the mountains decreases, as a rule, going southeast. In all this region the summits of the mountains are irregular, and sometimes sharp crested, from the outcropping edges of the generally highly-inclined strata. Northwest of the Coosa valley the mountains are generally level on top, forming table-lands 10 to 15 miles broad, separated by long and narrow valleys. Beyond the Tennessee river these table-lands are cut by erosion into a number of detached peaks, each with a level or nearly level top. These peaks overlook the valleys in steep escarpments, which, especially in the northeast, often attain truly mountainous proportions.

In the lower part of the state there are no elevations which at all deserve the name of mountains, and the highest hills of this region are due solely to erosion—the wasting of the softer rocks by the action of water.

VALLEYS.—Many of the valleys of the elevated region show a close dependence upon the geological structure; and while they are all due to erosion, their position has been in most cases, if not in all, determined by the relative positions of the outcropping edges of the strata of different degrees of hardness.

All the valleys in the mountainous region of the state, like the mountain ranges themselves, have a northeast and southwest direction. The most important of these valleys in many respects is that of the Coosa, which is the southern end of a series of valleys extending from New York to Alabama, and known in New York as the valley of the Hudson, in Pennsylvania as the Kittatinny or Cumberland valley, in Virginia as the Great valley, in Tennessee as the valley of East Tennessee, and in Alabama, as we have just seen, as the Coosa valley. The several outliers of this valley, which separate the parts of the table-lands and coal-fields, belong to the same general system.

The sandstones which form the capping of the mountain plateaus rest upon softer strata of shales and limestones, and the dip of all the strata is at a gentle angle toward the south or southwest, while the river cuts across at nearly right angles. These are the conditions under which escarpments are formed, such as make the southern border of the Tennessee valley across the state.

In the lower part of the state the valleys, like the hills, have very little relation to the geological structure, except in the case of the prairie region, which may be considered as a wide valley, since it is many feet below the hills that border it on the north and south.

CLIMATE.—The most potent influences which determine climate are latitude or distance from the equator, elevation above tide, and configuration of mountain chains, proximity to the sea, and the direction of the prevailing winds. In all these particulars the position of Alabama is favorable for a temperate and uniform climate. The geographical position and the mean elevation of the state have already been subjects of discussion.

Winds.—The prevailing winds during the autumn and winter months are from the northeast and northwest; during the spring and summer, from the southeast; and for the whole year, from the southeast and south, but the yearly mean directions are nearly evenly balanced.

Temperature.—Extremes of temperature are comparatively rare, and the extremes of heat during the summer months are especially moderated by the tempering winds from the Gulf of Mexico. In those parts of the state most remote from the Gulf their elevation above sea-level secures immunity from excessive heat. The mean annual temperature of the state is about 64.58° F. The means for the seasons are as follows: Spring, 63.9°; summer, 79.5°; autumn, 64.5°; winter, 50.4°. The maxima and minima of temperature fall almost without exception in the months of July and January, respectively.

In the lower part of the state, below the latitude of Montgomery, the mean temperature for the winter and for the year are nearly normal; that is, the lines of equal temperature run across the state from east to west, approximately parallel to the lines of latitude, the temperature depending thus almost exclusively upon the latitude.

Above Montgomery, however, two things interfere with this regularity, viz: 1. The cooling influence of the mountains, which has the effect of deflecting the isothermals southward. 2. The heating influence of wide river valleys like those of the Coosa, Warrior, and Tennessee, that are sunk in these highlands. By this cause these lines are carried northward of their normal position.

With these general principles in view, the distribution of the temperature will be readily understood.

The line of mean annual temperature of 68° F. crosses the state just south of Mobile; that of 64° just above Montgomery, curving, however, southward from Montgomery to Eufaula. The line of 60° follows approximately the curve spoken of as running from Columbus, Georgia, around to the northwestern corner of the state; that is, it follows the borders of the elevated or mountainous region, being, however, carried northward by the Coosa and the Warrior rivers and eastward by the Tennessee. The line of 56° is confined to the northeastern corner of the state, but is brought far to the south by the mountain plateau lying between the Coosa and the Tennessee rivers.

The case is similar with the lines of equal temperature for the winter. That of 52° runs nearly parallel with the thirty-first degree of latitude; that of 48° has its normal course through Selma and Montgomery, but is carried by the Coosa river as high up as the crossing of the Selma, Rome, and Dalton railroad at Coosa bridge; and that of 44° follows the margin of the mountainous region, except where it is carried by the Coosa river above Talladega and by the Tennessee river eastward nearly to Decatur. The line of 40° includes only the northeastern corner of the state, to which it is crowded by the Coosa and the Tennessee rivers.

The lines of equal temperature for the summer show much greater irregularity, caused apparently by the preponderating influence of the river valleys. Thus the line of 80° runs diagonally from Tallahassee, in Florida up to Tuscaloosa, by reason of the Alabama, Tombigbee, and Warrior rivers. The line of 78° curves, like some of those above mentioned, around the border of the mountainous region, being considerably indented by the Coosa and Warrior rivers, while it follows the valley of the Tennessee river through the whole of northern Alabama into the state of Tennessee beyond Chattanooga.

In the latitude of Montgomery the last frost occurs, as a rule, between the 5th and the 25th of April, and where the last frost is recorded in March the records show that its actual formation in April was prevented by unfavorable conditions, such as cloudy weather or brisk winds. The first frosts occur usually between the 10th and the 25th of October. When the first frost falls in November, the records always show that some time in October the temperature was sufficiently low for frost, the actual formation of which was prevented by the unfavorable conditions above mentioned.

The influence of topography upon the formation of frost is clearly seen in those parts of the state where the variations in level are considerable; for though both the mountains and the valleys are exposed to the same conditions, and radiation from each goes on at the same rate, the effects of the radiation will be felt in different degrees. As the air is cooled it becomes more dense, and in consequence flows down the slopes to the lower levels, where it accumulates. The elevated lands are thus never exposed to the full intensity of frosts, for their position affords a ready way for the escape of the cooled air, which flows down the slopes as fast as formed, and the reduction of temperature is in this way greatly retarded.

On the other hand, the valleys and lowlands not only retain all the cold air caused by their own radiation, but serve also as reservoirs for the cold air descending from the adjoining heights. The conditions for frost formation are thus greatly increased, and in a degree are proportional to the narrowness of the valley and the height of the adjacent hills.

Since the cotton-plant continues to grow and mature its fruit until cut off by frosts, it is obvious that the length of time between frosts becomes an important factor in determining the fitness of a locality for the production of cotton. Hence mountain lands, even with inferior soils, are steadily coming into favor for cotton planting.

Rainfall.—The supply of moisture for the rainfall of the southern states comes mainly from the Gulf of Mexico, the densest annual precipitation of 60 inches and upward being over the region of the delta of the Mississippi river and along the coasts of Louisiana, Mississippi, Alabama, and western Florida. An area of heavy annual rainfall, 50 inches and upward, spreads thence, with gradually diminishing amount, northeastward, including Louisiana, southwestern Arkansas, western Tennessee, the whole of Mississippi and Alabama, northwestern Georgia, and parts of middle, western, and southern Florida. Along the eastern coasts of Florida, Georgia, and South and North Carolina the influence of the Atlantic ocean is seen in the heavy precipitate of from 55 to 60 inches which falls there.

The distribution of the rainfall in Alabama for the year, and for the winter and summer seasons, is about as follows:

An annual precipitate of 56 inches and upward falls within a belt narrowest in the middle and widening out at both ends, and crossing the state diagonally from the southwestern to the northeastern corner. In the lower part of this belt an area including Mobile and Baldwin and parts of Washington, Clarke, Monroe, Wilcox, Dallas, Lowndes, Butler, Conecuh, and Escambia counties receives an annual rainfall of 62 inches and upward, reaching a maximum of 64 inches at Mount Vernon. In the extreme northwestern corner of the state is another small area whose annual rainfall is above 56 inches. Between these two areas the rainfall is less, falling below 50 inches in

the central part. Eastward of the main belt the amount of annual rainfall decreases, being between 44 and 56 inches over the southeastern part of the state, except in two small areas in Lee and Chambers and in Henry counties, where it ranges between 40 and 44 inches.

During the winter months (December, January, and February) we find the area of maximum rainfall running along the western border of the state within 30 miles of the Mississippi line, except where a branch is thrown off, including parts of Dallas, Wilcox, Lowndes, Montgomery, Butler, Crenshaw, Pike, and Bullock counties, and another deflection toward the east in the Tennessee valley, including parts of Lawrence, Limestone, and Madison counties. Over the rest of the state the winter rainfall is between 12 and 16 inches, except in a small area in the western part of Sumter county and a strip along the eastern border of the state below Chambers county, including parts of Chambers, Lee, Macon, Bullock, Barbour, Dale, Geneva, and all of Henry and Russell counties, where it falls below 12 inches.

During the summer months (June, July, and August) the greatest amount of rain falls south of a line running from the southwestern part of Choctaw county to the upper line of Dallas, and thence southeastward to the southeastern corner of the state, in Henry county. Within the area thus outlined the rainfall is 14 inches and upward, increasing to 18 inches and more in Mobile, Baldwin, Washington, Clarke, Monroe, Butler, Conecuh, Escambia, and Covington counties.

North of the Tennessee river, in Lauderdale, Limestone, Madison, and Jackson counties, we find another area of large summer rainfall, 14 inches and upward, and between the two, over perhaps two-thirds of the state, the summer rainfall falls below 14 inches.

In the meteorological region of which Alabama forms a part there are commonly observed two maxima of precipitation, the principal one about the end of July, the secondary one early in December; also a principal minimum early in October, and a secondary one toward the end of April. The range in Alabama, however, is moderate, and the distribution tolerably uniform throughout the year, as may be seen from the following statement:

The average rainfall of the state is 55.04 inches, and of this 13.86 inches fall during the spring months, 14.07 during the summer, 10.74 during the autumn, and 16.37 during the winter. (*a*)

The records kept at Montgomery show that no periods of wet weather extend over five days, and that when the periods are long heavy rainfalls are exceptional. During the months of March, April, and May thunder-storms are not unusual, and the quantity of rain which then falls is sometimes great. These storms come mostly from westerly directions, from southwest around to northwest, but most often from the southwest. The strong winds with which they are usually accompanied sometimes reach the force of hurricanes or tornadoes, which sweep over the country in a narrow track, usually of less than a mile in width. The tornadoes come almost without exception from the southwest, the wind having a gyratory motion, as is shown by the positions of the prostrated trees.

Snow falls occasionally in the months of January and February. In the lower counties of the state it is extremely rare, but northward there is usually at least one considerable snowfall during the winter.

GENERAL TOPOGRAPHICAL AND GEOLOGICAL FEATURES AND DIVISIONS.—Every geological formation occurring in the Appalachian region of North America has its representatives in the stratified rocks of Alabama, and this state therefore possesses a variety in its geology and topography not excelled by any member of the Union.

The main topographical features of any region are either inequalities of surface, caused by actual folds or wrinkles of the earth's crust, or are due to the degradation of the land by atmospheric or aqueous agencies. The two great factors which determine surface configuration are thus seen to be geological structure and erosion. In all cases difference in the quality of the material acted upon as regards resistance to erosion is an important subfactor, to which are due all those minor inequalities which constitute scenery. By atmospheric and other agencies the rocks decay and are disintegrated, crumbling down into soils, which rest upon and vary with the underlying parent rock, or which are removed by running water or other transporting agent and spread over regions more or less remote from their point of origin. A distinction is thus made between transported or drifted soils and those in place. All bottom or alluvial lands are of the nature of drifted soils, but these are always more or less related in composition to the uplands of the particular drainage basin in which they occur. On the other hand, certain parts of the state have been covered in comparatively recent times with transported soils, resulting from the commingling of the detritus of widely different geological formations, and often bearing very little relation to the underlying or adjacent rock masses. These, the true drifted soils, exhibit local variations which result from the influence of the underlying rocks upon which they have been deposited.

In the present position of the rock strata, whether approximately horizontal or much inclined in the nature of the connection between the topography and the geological structure and in the relations of the soils to the country rocks upon which they rest, are found the characters according to which, for convenience of study and description of its natural features, the state may be marked off into three tolerably distinct divisions: a middle, a northern, and a southern division.

The middle division is the southwestern terminus of a series of folded and faulted strata, which, under the name of the Appalachian chain, extends from the eastern states through Pennsylvania, etc., into Alabama.

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a The data for the above account of the climate are derived from the Smithsonian.

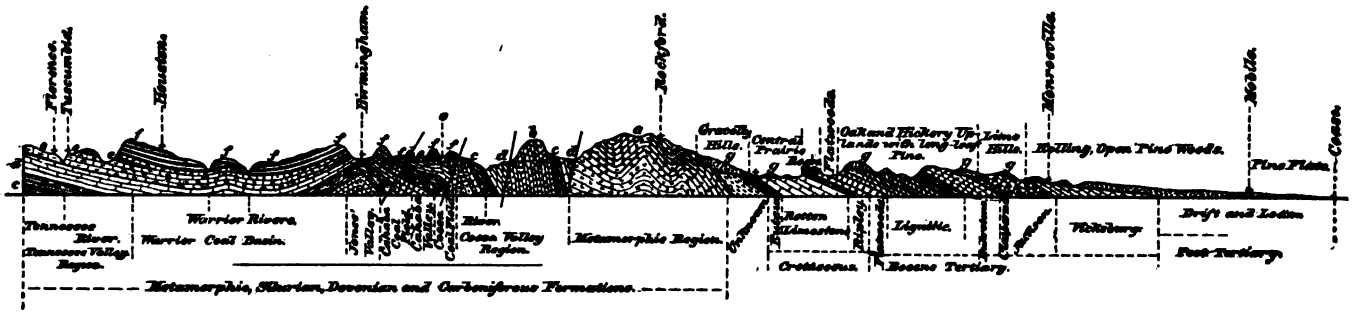
Throughout this part of the state the strata are usually inclined at considerable angles either toward the southeast or the northwest, and their outcropping edges have the general direction of northeast and southwest. The topographical features, ridges and valleys, are disposed in parallel strips or belts, having the same direction as rock strata, to which they owe their origin. With the exception of the bottom and alluvial lands, the soils of this division are in place, resting directly upon the rocks from which they have been derived.

Northwest of this middle division the southern terminations of the great Cumberland table-land and of the highlands of Tennessee extend down into Alabama. These two, together with the Warrior coal basin, constitute the northern division. Here the strata are approximately horizontal, except along the borders of certain outlying folds belonging to the middle division, and the influence of geological structure upon the topography is much less distinctly seen than in the preceding division. The soils, like those of the preceding division, and with the exceptions there noted, have been derived from the disintegration of the underlying rocks of the country.

In the southern division, with approximately horizontal position of the strata, we find the topography very slightly influenced by geological structure, but, on the other hand, almost exclusively the result of erosion, as determined by the differences in the materials of a single formation, the stratified drift or orange sand, which, except in parts of the prairie belt, covers the underlying beds over this whole division. In this division, therefore, the agricultural features depend, with the principal exception of the prairies, primarily upon the quality of these superficial transported beds, and not upon the rocks of the country. Local modifications of these widely-spread drifted soils, as before stated, are not uncommonly brought about by the influence of the underlying rock masses which they cover.

In the detailed descriptions which follow the divisions are taken up in the order previously given, which is also the order of their relative geological ages.

The relations above mentioned are shown by the following general section across the state along the broken line:



a Metamorphic rocks; *b* Silurian (Potsdam) sandstone; *c* Silurian shale; *d* Silurian limestones; *e* Sub-Carboniferous cherty limestones; *f* Coal Measures; *g* Beds of sand, gravel, and loam overlying the Cretaceous, Tertiary, and part of metamorphic rock.

Sandstone. *Shales.* *Metamorphic Slates.* *Limestone.* *Cherty Limestone.*

FIG. 1. General section across the state of Alabama from Florence, *southeastward* through Tuscumbia, Houston, and Birmingham to Rockford, Coosa county, and thence *southwestward* through Monroeville, Monroe county, and Mobile to the Gulf coast, showing the disposition of the geological formations and the geographical positions of the agricultural regions, together with their relations to the geological formations.

AGRICULTURAL SUBDIVISIONS OR REGIONS.—Under these general divisions the agricultural features of Alabama will be described in the following order:

MIDDLE DIVISION.

1. The *Metamorphic region*, including—
   - Red lands.
   - Gray lands.
2. The *Coosa Valley region*, with its—
   - Flatwoods.
   - Brown-loam and red-clay lands.
   - Gray cherty lands.

There are also included in this division the Coosa and Cahaba coal-fields, but they are described in detail under the succeeding head.

NORTHERN DIVISION.

3. *Coal Measures region*, including the sandy lands of—
   - The Coosa and Cahaba coal-fields.
   - The Warrior basin and plateau.
4. The *Tennessee Valley region*, the three subdivisions of which are—
   - Barrens.
   - Red valley lands.
   - Sandy lands of Little Mountain range.

SOUTHERN DIVISION.

5. *Oak and pine uplands region*, which includes—
   Oak and hickory uplands, with short-leaf pine.
   Gravelly hills, with long-leaf pine.
   Oak and hickory uplands, with long-leaf pine.
   Still further subdivided into—
   Brown-loam uplands, and
   Pine hills.
6. *Upper or central prairie region*, including—
   Black prairie or "canebrake".
   Hill prairies and Chunnenugga ridge.
   Blue marl lands.
7. *Post-oak flatwoods belt or region.*
8. *Lower prairie region, or lime-hills.*
9. The *Long-leaf pine region*, subdivided into—
   Rolling, open pine woods, with lime-sinks.
   Pine flats.
10. *Alluvial region* of Mobile river and the coasts.

MIDDLE DIVISION.

A line drawn on the map from the northeastern corner of the state southwestward to Tuscaloosa, and thence through Centerville, Clanton, Wetumpka, and Tallassee to Columbus, Georgia, would mark approximately the boundaries of this division.

A part of the Coal Measures of the Warrior field, though falling within the limits above given, is to be classed with the next division, and, on the other hand, Murphree's and Brown's valleys, in Blount and Marshall counties, and the continuation of the last-named valley northeastward along the Tennessee river through Jackson county, though outside these limits, is still to be included in this division, which, as thus defined, has an area of nearly 10,000 square miles, and embraces the following counties and parts of counties: All of Cleburne, Calhoun, Saint Clair, Shelby, Talladega, Clay, Randolph, Chambers, and Coosa, narrow belts through Jackson, Marshall, De Kalb, and Blount, southern Cherokee, most of Etowah, southeastern Jefferson, a small strip along the southeastern edge of Tuscaloosa, northern Bibb, eastern half of Chilton, southern Elmore, Tallapoosa, and Lee.

SUBDIVISIONS.—By reference to a geological map of the state it will be seen that this division includes: 1. The metamorphic region. 2. The valley of the Coosa, together with its outliers, the Cahaba, Roup's, Jones', Wills', Murphree's, and Brown's valleys, and the continuation of the latter along the Tennessee river to the northeastern corner of the state. 3. The Coosa and the Cahaba coal-fields.

These three subdivisions are best described separately.

THE METAMORPHIC REGION.

This being a part of the great Appalachian chain, includes some of the most elevated land in the state in the counties of Cleburne, Randolph, Chambers, Lee, Macon, Tallapoosa, Clay, Coosa, Elmore, and Chilton, comprising an area of 4,425 square miles.

GEOLOGICAL CHARACTERS.—The rocks of this region are the altered and crystallized sediments either of Silurian or preceding ages, and exhibit the greatest diversity, both in their chemical composition, in their physical characters, and in the nature of the topography and the soils to which they give rise. There are all gradations between the hard, almost indestructible quartzites to the easily-eroded marble; from the warm, fertile, and undulating granitic and gneissic land to the much broken, often sterile tracts formed by mica slates and other highly siliceous rocks. With the varying composition of the rocks come varying degrees of resistance to decay and erosion, and hence the great variety in the scenery of this region, where high and almost mountainous ridges alternate with rolling and sometimes rugged lowlands and valleys. In some parts the strata have undergone complete disintegration in place and have been converted into great masses of stratified clays, interlaminated with seams of quartz, which, gradually broken down, cover the ground with their angular fragments.

SOILS.—The depth to which this decay reaches depends on the nature of the rock and its position, and in many instances, even 20 or 30 feet below the surface, the rock is still much decomposed. At the surface a loam with not much appearance of stratification overlies the decayed slates to the depth of several feet in valleys, but much less along the slopes and on the summits. This loam forms the soils and subsoils, which are thus seen to be in most cases directly related to the underlying beds. These soils and subsoils have all probably been slightly shifted from their original place, especially in the valleys, but seldom to that distance where their relationships cannot be readily traced to the underlying or immediately adjacent rock masses.

The two principal soil varieties commonly recognized by the farmers are those which make the gray and the red lands respectively. Of each of these, however, there are numerous subvarieties, exhibiting all grades of color and of fertility. The gray lands may be derived from feldspathic rocks, such as granite and gneiss, in which case they are often quite fertile, or from siliceous mica slates or other quartzose rocks, when they may be almost barren. Similarly, the red lands, when derived from feldspathic rocks, such as hornblendic gneiss, etc., rank high in productiveness, while those resulting from the decay of certain mica or clay slates, bearing garnets or other ferruginous minerals, frequently lie at the other extreme. In the present state of our knowledge it is impossible to mark with accuracy the localities where these several soil varieties occur throughout the metamorphic region; but what can at present be said concerning their occurrence will be found under the head of each county.

Of the true gray granitic (feldspathic) soils there is only a limited area in this state, but a belt of this kind of land passes through Rockford and Bradford, in Coosa county. It is seen again near Blake's ferry, in Randolph, and near Louina, in the same county; then near Milltown, in Chambers county. Indeed, the granite itself, so far as it has yet been observed, passes everywhere, by insensible gradations, into a schistose or stratified rock, or into gneiss, and thus our granitic soils might more properly be classed as gneissic throughout. No analyses of soils from those localities where the so-called granite makes the country are at hand.

The gneisses vary in composition from granitic gneiss to mica-schist, which contains only quartz and mica, and vary in fertility in a corresponding degree. On the other hand, variations brought about by an intermixture of iron-bearing minerals, such as hornblende, garnets, etc., are seen in the hornblendic gneisses and other similar rocks. Throughout the region of occurrence of the gneissic rocks the variations of soils, produced in the manner alluded to, are so numerous, and follow each other in so irregular a manner, as to defy classification and localization, except in the most general way. Thus, it may be said that the gneisses (with all their variations) are of more frequent occurrence in the southeastern half of the metamorphic region, while the more siliceous and argillaceous or clayey rocks prevail, as a rule, in the northwest. Still, such a statement expresses only the most general relations, for rocks of all kinds occur in both divisions.

Of the two principal soil varieties above named, that of the red lands is derived from the decomposed hornblendic gneisses and slates, which in many places, where exposed in washes or gullies, are seen to be merely stratified clays, containing fragments more or less angular of the quartz veins or seams, which are nearly always interbedded with the other rocks of this region. This red soil (the color of which comes from the iron of the hornblende) is considered best adapted to the production of corn and other grains. Its natural growth consists of the various species of oaks (white, post, Spanish, red, and a few black-jacks), hickory, poplar, and some short-leaf pine, especially where the red and gray soils overlap, making mulatto-colored soils. The top stratum of this soil, from 2 to 3 inches in depth, is often a dark chocolate-brown color, but below it becomes a brighter red, and at varying depths, from 10 to 15 feet, becomes a yellowish hard clay. Where the freshly decomposed rocks are seen the color is yellowish rather than red, the latter color being darker and more intense apparently the further removed the soil is from its original position and the more it is affected by the decay of the vegetable matter. When first cleared, these lands were thought to be the best in the country, and many fine farms are still found upon them. The majority of the farmers now, however, seem to prefer the gray soil, as being more certain, more easily tilled, and even more fertile. The red lands were the first to be cleared up by the original settlers, and most of the older farms and fine old country residences are upon this kind of land.

The gray soils result from the disintegration of gneisses and mica slates which contain comparatively little or no hornblende or other iron-bearing minerals. They are commonly somewhat sandy, usually light-colored, gray to dark gray, sometimes nearly black, with very often, however, a decidedly reddish color similar to that of the hornblendic soils above described. Fragments of the partially-decayed gneiss of a light-gray color often lie embedded in reddish and even red clays or clayey sands. These gray soils are easily tilled, are certain of crop even with moderately favorable seasons, and are better suited than the red to the culture of cotton. Below some three or four inches of dark gray sandy top soil there is usually a lighter colored but somewhat yellowish subsoil. The timber is much the same as that upon the red lands, viz, oaks and hickory, with a few short-leaf pines.

The subjoined analyses will show the chemical characters of these two soil varieties:

No. 78. *Red lands soils* from 6 miles north of Opelika, Lee county (S. 16, T. 20, R. 27 E.). Depth, 10 inches; vegetation, red, Spanish, and post oaks, hickory, and a few short-leaf pines; color, dark-red.

No. 79. *Gray gneissic (isinglass) soil* from 6 miles north of Opelika, Lee county (S. 17, T. 20, R. 27 E.). Depth, 8 inches; vegetation, red, Spanish, and post oaks, hickory, and a few short-leaf pines; color, grayish-brown.

Gneissic soils, Lee county.

	RED LANDS SOIL.	GRAY LANDS SOIL.
	No. 78.	No. 79.
Insoluble matter	68.710	79.170
Soluble silica	3.830 } 72.540	3.256 } 82.426
Potash	0.350	0.268
Soda	0.119	0.067
Lime	0.043	0.167
Magnesia	0.050	0.130
Brown oxide of manganese	0.100	0.093
Peroxide of iron	10.740	3.144
Alumina	9.237	5.120
Phosphoric acid	0.170	0.229
Sulphuric acid	0.080	0.043
Water and organic matter	7.011	7.712
Total	100.440	99.429
Hygroscopic moisture	7.40	4.54
absorbed at	27.8 C.°	26.7 C.°

Of these two soils, in proportion to the amount of insoluble matter, the gray is decidedly better in respect of potash, phosphoric acid, and lime, and is probably more thrifty. The red soil is rather deficient in lime, but in retentiveness of moisture it is superior to the other. Both are fairly good soils.

Running northeast and southwest through the metamorphic area near the southern border there is a belt of varying width, in which hydromica slates, often highly graphitic, are of frequent occurrence. These mica slates are usually filled with garnets, are much decomposed, and alternate with thin beds of clay slate, which is occasionally so highly graphitic as to be used as lubricating material. In Randolph and Tallapoosa counties these rocks are abundantly found, and details of their occurrence will be found under those headings. The soil derived from these rocks is of yellowish-gray color, finely pulverized, and supports a growth of the usual upland character.

Mica slates containing the common micas, such as muscovite and biotite, are also of frequent occurrence, and the soils yielded by them are also of varying degrees of fertility, being between a first-rate gneissic soil, on the one hand, and a poor sandy material on the other. These variations have already been the subject of remark under the heading of the gneissic soils.

As to the distribution of these mica slates no general rule can be given, since they alternate in so many ways with the other metamorphic rocks. The following analyses are probably fairly characteristic of these two varieties:

No. 107. *Mica slate soil* (graphitic, hydrous mica) from 4 miles north of Roanoke, Randolph county. Depth, 8 inches; vegetation, black, red, post, and black-jack oaks, with a few short-leaf pines and hickories; color, light-yellow.

No. 103. *Mica slate soil* (garnetiferous, common mica) from S. 27, T. 19, R. 7 E., Clay county. Depth, 8 inches; vegetation, black, red, and Spanish oaks, with a few hickories and chestnuts; color, buff-yellow, passing downward into orange. The subsoil is a tolerably stiff red clay.

Mica slate soils.

	RANDOLPH COUNTY.	CLAY COUNTY.
	Mica slate soil (graphitic, hydrous mica).	Mica slate soil (garnetiferous, common mica).
	No. 107.	No. 103.
Insoluble matter	77.354	66.174
Soluble silica	3.986 } 81.340	9.263 } 75.437
Potash	0.536	0.351
Soda	0.086	0.246
Lime	0.010	0.038
Magnesia	0.145	0.155
Brown oxide of manganese	0.146	0.151
Peroxide of iron	6.861	9.303
Alumina	5.693	8.083
Phosphoric acid	0.067	0.137
Sulphuric acid	0.057	0.090
Water and organic matter	4.772	5.706
Total	99.713	99.697
Hygroscopic moisture	4.612	5.91
absorbed at	7.2 C.°	6.1 C.°

Both these soils are deficient in lime, and No. 107 is also deficient in phosphoric acid. The rock from which No. 107 is derived has usually been called "talcose slate", but a full analysis shows that it contains only a small percentage of magnesia. Soils like No. 107 are quite common throughout the "gold regions", which, as is well known, does not rank as the best farming country. The rock from which No. 103 is derived contains the ordinary mica, and is filled with garnets of large size, often as much as 2 inches in diameter. This soil is fairly productive in good seasons, but cannot stand much dry weather, and, being rather light, soon wears out. It is a good representative of the better class of mica slate soils, and does not exhibit the sterility characteristic of some of them, especially those derived from a mica slate of a purple color running through Cleburne, Clay, and Coosa, into Chilton county, and which are almost barren, supporting a growth consisting almost entirely of stunted long-leaf pines and black-jacks.

A comparison of the four analyses given on page 16 shows that the soils may be divided into two general classes, viz, sandy and clayey or loamy. To the first belong the two gray soils, *i. e.*, the gneissic and the hydromica; to the second, the red soils, *i. e.*, the hornblendic and the mica slate; and, in the most general terms, the soils of this region are usually grouped under one or the other of two heads, as sandy or gray, and as loamy or red soils. In some rare instances we have loamy or clayey soils which are deficient in red coloring matter, but as a general thing the clayey and the ferruginous matters are closely associated.

This close agreement of the soils in composition, though derived from rocks of different kinds, bears out what was said concerning the relations between the different rocks themselves; for since the great majority of the rocks of this region may be classed with the gneisses, and as these vary in the one direction, by the accession of hornblende or other iron-bearing minerals, through hornblendic gneisses to almost purely hornblendic slates, so the corresponding soils pass from light-grayish colors through the various grades of yellow to deep red; and since the increase in the amount of hornblende is usually attended with a decrease in the amount of free quartz or silica, it is easily seen that these soils are less and less distinctively sandy as they pass from light to red colors.

Variations in the gneisses take place in another direction by the gradual disappearance of the feldspar and the corresponding increase in the proportion of quartz and mica, as when the gneiss passes into mica slate. In this series the light-colored feldspathic soil gradually loses its fertility, becoming more sandy and sterile till the sandy micaceous soils of the typical mica slates are reached. No analyses are yet on hand of the clay slate soils.

THE COOSA VALLEY REGION AND ITS OUTLIERS.

The wide valley, with prevailing calcareous rocks, which lies between the metamorphic area on the one hand and the southeastern edges of the Coosa and Cahaba coal-fields and Lookout mountain on the other has received the name above given from the Coosa river, which traverses its whole length. Geologically it is the continuation of the valley of eastern Tennessee; and, indeed, the valley of which this is a part, and which has been described by Professor Safford as a complex trough fluted with scores of smaller valleys and ridges, extends at least from the Susquehanna river to middle Alabama.

The main valley of the Coosa, with the limits above given, is from 15 to 20 or 30 miles wide, and is closely furrowed with parallel valleys and ridges, all trending northeast and southwest. This valley is embraced in the counties of Cherokee, Cleburne, Calhoun, Etowah, Saint Clair, Talladega, Shelby, Coosa, and Chilton, and has an area, including its ridge lands, of 2,580 square miles. Several outlying valleys, with very similar geological structure and soil varieties, may be most conveniently described in connection with it.

These outliers are: 1. The Cahaba valley, lying between the Coosa and Cahaba coal-fields, in the counties of Saint Clair, Jefferson, Shelby, and Bibb, its area being 385 square miles. 2. Roup's and Jones' valley, between the Cahaba and Warrior coal-fields, in Jefferson, Tuscaloosa, and Bibb counties; area, 285 square miles. 3. Wills' valley, between Lookout and Sand mountains, in De Kalb, Etowah, and Saint Clair counties; area, 460 square miles. 4. Murphree's valley, in Etowah and Blount counties; area, 110 square miles. 5. The Blount springs, or Brown's valley, which is a prolongation into Alabama of the Sequatchie valley of Tennessee, and runs through Jackson, Marshall, and Blount counties, having an area of about 460 square miles.

GEOLOGICAL FORMATIONS.—The strata which appear at the surface and contribute to the formation of the soils in all these valleys are the representatives of all the geological formations occurring in Alabama, from the primordial or lowest division of the Lower Silurian up to the base of the Coal Measures. In the following statement is given, in descending order, the names and geological positions of these strata, so far as their equivalence has been made out:

Carboniferous.....	7. Coal Measures of the Warrior, Cahaba, and Coosa fields.	
Sub-Carboniferous.	6. Upper, Calcareous, mountain limestone.	
	5. Lower Siliceous, siliceous group.	
Devonian.....	4. Black shale.	
Upper Silurian....	3. Clinton or Red Mountain group.	
Lower Silurian....	2. Trenton and Chazy, shales and limestones.	
	1. Calciferous and Potsdam..	*e.* Dolomite or magnesian limestone.
		d. Shale (calcareous shales).
		c. Upper sandstone (calcareous sandstone).
		b. Potsdam sandstone proper.
		a. Semi-metamorphic shales and conglomerates.

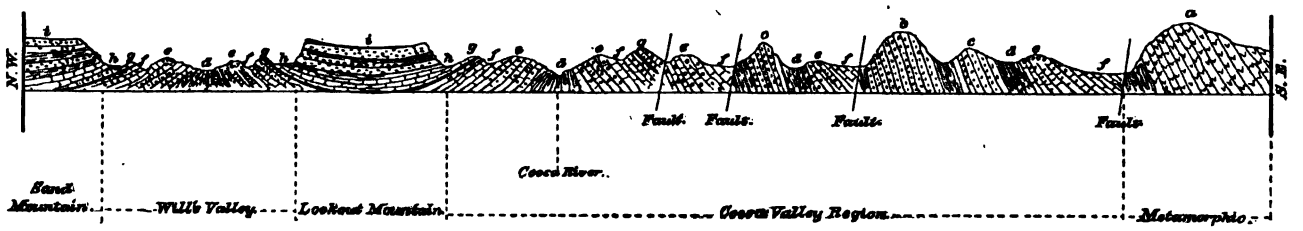
The lithological and other characters of these different formations, so far as they are of importance from an agricultural point of view, will be given in the special description of the soils.

COOSA VALLEY.

Under this name is included that belt of 30 or 40 miles width east and west lying between the metamorphic area on the one hand and the Coal Measures on the other, and extending from the eastern border of the state, in the counties of Cherokee and Calhoun, southwestward for 120 miles.

With reference to these mountainous borders it may be considered as one valley, but in reality it consists of several parallel valleys separated by ridges of greater or less height. The highest of these ridges are found in the southeastern part of the valley, where they attain true mountainous proportions.

Section from Sand mountain, on the northwest, to the metamorphic region on the southeast: showing the geological structure of the Coosa Valley region, Lookout mountain, and an outlying anticlinal valley (Wills').



EXPLANATION.—*a*. Mountains of the *Metamorphic region*. *b*. Sandy mountain lands—*Potsdam sandstone*. *c*. Ridgy lands of the *Upper Sandstone*. *d*. Red valley lands of the *shale* and the lower part of the *Magnesian limestone*. In the Coosa River region and central parts of Wills' valley the shale forms "flatwoods". *e*. Loams and cherty gravelly ridge lands, based on the *Magnesian limestone*. *f*. Brown loams of the valleys, based on *Trenton limestone*. *g*. Red ore ridges. *Silurian* sandstones and ore on one side and *sub-Carboniferous* cherty limestones on the other. The cherty gravel covers the side next to the Coal Measures. *h*. Brown loams of the valleys, based on *sub-Carboniferous* limestones. *i*. Sandy lands of Lookout and Sand mountains, *Coal Measures*. The sandstones, etc., of Coal Measures form the borders of the anticlinal valleys.

The structure of the Coosa Valley region, as well as that of an outlying anticlinal valley, will be easily understood by an examination of the accompanying sketch, which represents a section from Sand mountain, across Wills' valley, Lookout mountain, and Coosa valley, to the mountains of the metamorphic region. The section is taken from northwest to southeast, at right angles to the general direction of the strata, and the sketch does not pretend to give the minute details of structure, but only its broad outlines, and it is therefore in great degree diagrammatic.

The structure of the Coosa valley varies with the locality. From the Georgia line down to Gadsden it consists of two parts, the western being a large anticlinal, and the eastern being formed of strata repeated by faults. The eastern side of the anticlinal is itself cut short by a fault. Below Gadsden the anticlinal turns westward from the river, and is merged into Jones' valley, while the Coosa valley proper is altogether within the area of the faulted series.

The sketch, taken together with the lithological and topographical characters given in connection with the special description of the soils, will show very clearly the part borne by each formation in the production of the topographical features of this valley. It will be noticed that the ridges are of four kinds, viz: in the anticlinal, the red ore ridges, usually steep, with chert fragments on one side and sandstone and limestone on the other; the ridges of the dolomite, rounded and covered with masses of chert. In the eastern part of the Coosa valley the ridges are the chert ridges of the dolomite, the sandstone ridges of the upper sandstone, steep and sharp-crested, but not high, and lastly the mountains of Potsdam sandstone.

The valley-making formations are the sub-Carboniferous in part, the Trenton and Chazy, the calcareous parts of the dolomite, and the shale. The first of these (sub-Carboniferous) is found only in the anticlinal part of the valley; the others are found in both parts. The immediate valley of the river as far south as Gadsden is underlaid by the shales, covered, however, in great measure, with the sands and pebbles of a later period. The dolomite, as usual, forms the greater part of the superficial area of the ridgy valleys on each side of this central portion, and, from an agricultural point of view, is perhaps the most important formation. (*a*)

OUTLIERS OF THE COOSA VALLEY.

Cahaba valley.—This valley lies between the Coosa and Cahaba coal-fields. In its geological structure it resembles the eastern part of the Coosa valley, for a fault on its western edge brings the upper sandstone up to the level of the Cahaba Coal Measures, and going thence eastward we pass, in ascending order, over the following strata: Upper sandstone, the shale, the dolomite, Chazy and Trenton, Clinton, black shale, sub-Carboniferous, and Coal Measures (Coosa field). As in other cases, the greater part of the area of the valley is made by the strata of the magnesian limestone or dolomite.

Roup's and Jones' valley.—These names are given to the two ends of the valley lying between the Cahaba and the lower part of the Warrior field, merging into the Cahaba and Coosa valleys above Springville.

Wills' valley, Murphree's valley, and Brown's valley.—There are troughs sunk in the Coal Measures of the northeastern or plateau division of the Warrior field. In structure these are all, with the exception of the Cahaba valley above described, anticlinal folds in the Warrior measures, furrowed out subsequently by erosion. While the

a In the sketch the dolomite does not occupy its proper proportion of the area.

floors of these valleys are much lower than the rims which bound them (for the folding involved also the strata of the Coal Measures for a short distance on each side), they are nevertheless considerably higher than the synclinal basins of the Coal Measures, between which they lie, and for that reason water rising in these valleys sooner or later breaks through the mountain rim and flows off into the streams which drain the basins.

Exceptions to this general statement are found in what has been termed the plateau region of northeastern Alabama, and an examination of the map will show that the tributaries of the Tennessee in Marshall and De Kalb counties rise on the plateau near the edge of Wills' valley, flowing down and across the plateau, while the streams rising in the valley flow along it to each end of the same and do not break across the Coal Measures on either side.

The section on page 18 represents in a general way the geological structure of all these valleys, and shows with sufficient distinctness the parts borne by each of the formations appearing in them, determining their topography, the remarks under the Coosa valley applying here also. The structure is, however, especially in the southwestern part of this region, rarely so simple as is represented in the section, for the anticlinal fold has in some cases been thrust or lapped over toward the northwest, thus causing some of the more recent formations to lie beneath the older, and in addition to this, by reason of a fault or break in the strata, the red-ore ridge, on the western side of the valley, has been duplicated. This duplication of the Red mountain is characteristic of the valley from the upper edge of Tuscaloosa county nearly through Jefferson. On the western side of the valley also the strata are usually very nearly vertical, and a very prominent ridge is made by the thick bed of a conglomerate which lies at the base of the Coal Measures. At a short distance from this ridge the strata of the Warrior measures have their usual nearly horizontal position.

The red-ore ridges are commonly of very unequal size on the two sides of the valleys, rising to the dimensions of small mountains on one side, while on the other they are so insignificant in size as to be often overlooked entirely.

SOILS OF THE COOSA AND OUTLYING VALLEYS.—Classified according to color and general physical characters, the soils occurring in these valleys are either red or brown loams derived from the pure calcareous formations, such as parts of the shale, the dolomite, Trenton, and sub-Carboniferous; or lighter colored to gray siliceous soils, usually filled with angular, flinty gravel, and resting on a yellowish clayey subsoil derived from cherty limestones of the dolomite and of the sub-Carboniferous; or the light sandy loams which result from the disintegration of sandstones such as make up the greater part of the Potsdam proper, the upper sandstone, and the Coal Measures. But since the soils of each of these classes vary according to the geological formation to which they owe their origin their discussion in connection with these formations will best bring out their peculiarities of composition and explain their distribution in the valleys.

Acadian slates and conglomerates.—These have received notice under the preceding division, since they are more or less metamorphosed and crystalline in texture, and are otherwise closely associated with the true metamorphic rocks.

Potsdam sandstone.—The principal rock of this group has already been mentioned as a rather coarse-grained sandstone, and hence the resulting soil is sandy. In many places the soil is thin and vegetation scanty and stunted, but occasionally the growth is vigorous, consisting of the upland oaks, chestnut, and short-leaf pine. By reason of the mountainous character of the country made by these rocks very little of this soil is under cultivation, but there are many spots of good grazing ground. The Potsdam sandstone, in a series of outlying mountains, forming an interrupted chain, skirts the western border of the metamorphic region and extends through the counties of Cherokee, Calhoun, and Talladega.

Upper sandstone.—The soils derived from this formation are usually somewhat calcareous, though sandy, but the sharp-crested, steep ridges to which they are confined are seldom under cultivation. The entire thickness of the formation is inconsiderable, and as the strata usually lie tilted at high angles the superficial area occupied by them is quite limited. Isolated ridges of these rocks are found in the Coosa valley, in the counties of Cherokee, Calhoun, and Talladega, and in the Cahaba valley in Shelby and Saint Clair counties. Besides these occurrences, the mountains of Potsdam sandstone above described have usually a narrow border of these rocks on their eastern slopes.

The shale.—This formation in its outcrops presents two well-marked phases. Its lower beds are mostly shales, which, at the surface, have been thoroughly leached of calcareous matter, and generally break up into small fragments having very much the appearance of shoe-pegs. The colors of these shales are chocolate-brown, red, greenish, and gray. The soils formed from these materials are usually thin, and, though considered productive in good seasons, are liable to injury from drought. The timber is a mixture of chestnut, red, and white oaks, dogwood, and hickory. The valleys occupied by these variegated shales are ridgy, the shale ridges being often almost bare of soil. Areas of these shales are usually associated with the outcrops of the upper sandstone, with the upper strata of which they are closely related lithologically, and characteristic occurrences are not infrequent in Bibb county, northeast of Centerville, near Pratt's Ferry, in the vicinity of Montevallo, and Helena, in Shelby, and along the southeastern flanks of the isolated ridges of the upper sandstone and the mountains of Potsdam sandstone in Talladega, Calhoun, and Cherokee counties.

On the other hand, the upper strata of the formation are frequently thin sheets of limestone, alternating with seams of clay and with thin beds of sandy and aluminous shales. These beds often occupy the central parts of the anticlinal valleys as a mass of greatly contorted, usually nearly vertical strata, of which the thin-bedded limestone forms the greater part, the shales and clay being mostly weathered out, giving rise to a stiff clayey soil, through which the edges of the limestone protrude.

Flatwoods.—Where the clayey portions predominate and the drainage is defective level tracts are formed, which are known as "flatwoods", and which are usually uncultivated, though the timber indicates a soil by no means sterile. The prevailing timber of the flatwoods is post oak and short-leaf pine. The soils are usually of a greenish-yellow color, sometimes red in places, and occasionally nearly black. Where roads cross the flatwoods they are easily cut up into deep, muddy ruts, in which water stands for a long time. Occasionally a high place may be encountered with sandy soil and under cultivation, but these spots form a very small proportion of the whole area of the flatwoods.

Some of the largest bodies of flatwoods are found in the anticlinal part of the Coosa valley below Gaylesville, in Cherokee county, extending down to Gadsden (well exposed below Cornwall, at Cedar Bluff, and below Round mountain), and thence below Gadsden, in the direction of Springville, nearly to the latter place; also in Jones' valley between Elyton and Jonesboro', and in small patches farther south in Jones' and Roup's valley.

In the immediate valley of the Coosa river the shales have usually a superficial covering of sand and pebbles belonging to a much more recent formation, but along the river bluffs they may be seen underneath the surface beds. Throughout these flatwoods the outcroppings of the limestone are frequent, and in places there is very little soil, the rocky surface being then usually occupied by cedar glades. Similar glades are also often formed by the shaly limestones of the Trenton period.

From the flatwoods between Springville and Gadsden a specimen of soil was collected which may be considered as a representative. The analysis is as follows:

No. 70. *Flatwoods soil* (the Lower Silurian shale) from 3 miles northeast of Asheville, Saint Clair county. Depth, 10 inches; vegetation, chiefly post oaks and short-leaf pine, with red, Spanish, and a few black-jack oaks. Color, gray on top, changing within 3 inches to buff-yellow.

Flatwoods soil (Lower Silurian shale).

	No. 70.	
Insoluble matter	70.650	79.583
Soluble silica	8.933	
Potash		0.277
Soda		0.078
Lime		0.159
Magnesia		0.478
Brown oxide of manganese		0.079
Peroxide of iron		6.528
Alumina		7.497
Phosphoric acid		0.075
Sulphuric acid		0.013
Water and organic matter		4.777
Total		99.544
Hygroscopic moisture		11.15
absorbed at		27.2 C.°

The analysis shows that this is not such an inferior soil as its total neglect by the farmers would indicate, although the phosphates and vegetable matter are low. The natural growth, also, which is of fine, sturdy trees, tells in its favor. Many soils are successfully tilled which have no better chemical composition than this. Physically, however, it is too heavy and cold for cultivation, except where mixed with sand, as is the case near the banks of some of the streams which traverse it. Almost the only inhabitants of the flatwoods are to be found along these water-courses. During the winter and spring, by reason of mud and holes, the roads are almost impassable. In its uppermost portions this formation exhibits very similar strata to the lowest beds of the next succeeding, there being no well-defined line of demarkation between them.

The great body of deep, red-colored, clayey loams occurring in the Coosa Valley region, and especially in its eastern part, may be assigned, as to their origin, either to the lowermost of the beds of the shale or to the uppermost of the dolomite. They will be more particularly described under the next head, though in part, without doubt, belonging here.

The magnesian limestone, or dolomite.—This in Alabama has the widest distribution of any of the calcareous formations, and for this reason, and because it underlies a large proportion of the cultivated valleys in this part of the state, its importance from an agricultural standpoint is very great. It has been stated that the lower beds of the dolomite are more calcareous, the upper, as a rule, siliceous or cherty, and the resulting soils in their extremes are of two kinds:

1. A clayey loam of light-yellowish to orange-red colors and of varying thickness, the average being perhaps one and a half feet. The subsoil is usually heavier, being a rather stiff clay or clay loam of a red or yellow color. Both soil and subsoil are often filled with lumps of limonite or brown iron ore. Beneath the subsoil, at varying depths, lies the dolomite or limestone. There is a great variety in the color of the top soil between a very light-yellow, almost gray, and a deep red and brown, but the subsoil is commonly a yellow or red clay, and it is not unusual to find these soils and subsoils, especially those of lighter colors, filled with angular fragments of chert.

The characteristic timber upon the red lands is red, Spanish, post, and black-jack oaks, hickory, short-leaf pine, and dogwood; in low grounds, sweet gum and sour gum in addition to the above.

Some of the best farming lands in the state are based upon these lower beds of the dolomite and upon the immediately underlying calcareous parts of the shale, and their widest distribution is to be seen in the eastern part of the Coosa valley, in Cherokee, Calhoun, and Talladega counties, and southward, in the same direction, in Shelby and Bibb counties. The greater part of the red and brown loams with deep red-colored subsoils occurring along the eastern border of this long series of valleys is derived from the dolomite, but red and brown loams of a somewhat similar nature are also derived both from the shale below and from the Trenton rocks above the dolomite. In the anticlinal valleys these lower beds of the dolomite do not form the surface to so great an extent, and the deep red soils are of less frequent occurrence than in the Coosa valley.

2. The upper siliceous beds of the dolomite, in disintegrating, yield as a rule gray soils, which are filled with angular chert fragments. The subsoils are mostly of a yellowish to red color and of clayey substance, though the clayey substratum may sometimes lie at considerable depths below the surface. The agricultural characters of the lands made by these upper beds vary between wide limits, from good brown loams on the one hand to gray siliceous and nearly barren soils on the other.

The cherty portions of the dolomite, from the weathering away of the calcareous part, gradually accumulate and protect the strata from further erosion, and in this way the chert ridges so characteristic of the formation originate. The chert, which is of concretionary nature (and not bedded), occurs sometimes in masses of great size, and the surface of the hills is so covered as to leave very little soil exposed, and that of a highly siliceous character. In such cases the growth is chiefly of long-leaf pine and black-jack oak. The broad chert ridges of the Coosa valley in Cherokee, Calhoun, Talladega, and Shelby counties are very commonly timbered with the long-leaf pine.

Occasionally the country formed by this part of the dolomite is rolling or slightly broken, rather than hilly, varied with lime-sinks and outcrops of the cherty dolomite. The southwestern part of Talladega county, near the Coosa river, furnishes a good example of these rolling piny woods, which in many respects remind one of the rolling piny woods of the southern counties. Such soils have little to recommend them, and we find the country almost uninhabited, except along the banks of the streams which drain it, and these are few in number. Where the chert is less prominent as a surface material the gray lands are frequently of very fair quality, and, while not so fertile as some of the red lands, are thought to be better adapted to the cotton crop, especially where commercial fertilizers are used.

The better grades of the gray, gravelly lands are timbered with oaks and short-leaf pine, hickory, dogwood, etc., while those of a sandier nature have the long-leaf pine, associated with post, Spanish, and black-jack oaks and small hickories. The gray pine lands near the Alabama furnace, in Talladega county, may be taken as types of this last-named variety.

In the outlying valleys there is always at least one of these chert ridges occupying the center of the valley, but it is more commonly separated into two by a narrow valley resting on the more calcareous lower parts of the dolomite, or by a belt of flatwoods derived from the underlying shales. These ridges are timbered usually with post, black-jack, and Spanish oaks, with some chestnut and short-leaf pine. The long-leaf pine is also found where the siliceous matter preponderates. Occasionally the cherty matter assumes the form of a sandstone or conglomerate, which forms considerable hills. This is best seen in the Salem hills, near Jonesboro', in Jones' valley, and again a few miles southwest of Springville, in Saint Clair county. The Salem hills have a characteristic growth of long-leaf pine, as yet untouched by the woodman's ax.

The chemical composition of typical soils derived from the rock varieties occurring in the dolomite are fairly exhibited in the analyses of four red-loam soils and one gray, cherty soil taken from several localities. Only the better soils, such as are under cultivation, have been examined. The barren soils of the chert hills and pine woods are not often in cultivation, and have not, therefore, been selected for analysis. In Calhoun, Talladega, Shelby, and Bibb counties the red soils appear most prominently.

No. 71. *Red valley soil* from 1½ miles south of Jacksonville, Calhoun county. Depth, 12 inches; vegetation, red, Spanish, and post oaks, hickory, dogwood, and short-leaf pine; color, dark-red. This kind of soil occurs over a good proportion of the valley below Jacksonville and around Alexandria.

No. 76. *Red valley soil* from near Mrs. Walker Reynolds' place, Talladega county. Depth, 12 inches; vegetation, red, Spanish, white, and post oaks, sweet and sour gums, and hickory; color, dark-red. This is a fair sample of the red soils which make the valley of Talladega one of the most beautiful parts of the state. The same soils are seen farther south, in Shelby and Bibb counties, those around Montevallo being of this nature.

No. 45½. *Red upland soil* (dolomite) from near Pratt's ferry, Bibb county. Depth, 12 inches; vegetation, white, black, post, and other oaks, chestnut, hickory, walnut, mulberry, dogwood, with occasional black gum and cedar; color of soil, brown; of subsoil, reddish-brown.

No. 67. *Little Cahaba valley soil* (dolomite) from 6 miles southwest of Springville, Saint Clair county. Depth, 12 inches; vegetation, red, black, and Spanish oaks, hickory, chestnut, sweet gum, and persimmon; color, reddish-brown.

No. 69. *Gray upland soil* (dolomite), 1 mile north of Ashville, Saint Clair county. Depth, 10 inches; vegetation, red and Spanish oaks, poplar (*Liriodendron*), dogwood, and short-leaf pine, with some sweet gum and persimmon; color, brownish-gray. Both soil and subsoil are commonly filled with angular fragments of chert.

Magnesian limestone soils (Lower Silurian).

	CALHOUN COUNTY.	TALLADEGA COUNTY.	BIBB COUNTY.	SAINT CLAIR COUNTY.	
	Red valley soil.	Red valley soil.	Red upland soil.	Little Cahaba valley soil.	Gray upland soil.
	No. 71.	No. 76.	No. 45½.	No. 67.	No. 69.
Insoluble matter	80.520	64.070	81.480	73.433	83.440
Soluble silica	3.941 } 84.461	7.647 } 71.717	6.530 } 88.010	7.459 } 80.892	4.230 } 87.670
Potash	0.290	0.339	0.328	0.240	0.109
Soda	0.062	0.111	0.027	0.041	0.018
Lime	0.112	0.091	0.255	0.225	0.202
Magnesia	0.260	0.143	0.210	0.476	0.181
Brown oxide of manganese	0.057	0.137	0.189	0.241	0.042
Peroxide of iron	5.011	7.157	2.016	5.518	2.178
Alumina	5.722	11.229	5.614	7.498	4.521
Phosphoric acid	0.126	0.176	0.110	0.165	0.093
Sulphuric acid	0.056	0.010	0.167	0.007	0.048
Water and organic matter	4.501	8.298	8.587	4.719	5.301
Total	100.658	99.408	100.513	100.022	100.363
Humus		0.984			
Available phosphoric acid		0.020			
Hygroscopic moisture	8.063	19.400	4.528	9.525	8.528
absorbed at	26.7 C.°	24.4 C.°	28.3 C.°	7.2 C.°	26.7 C.°

In comparing these soils with each other it is seen that they are all tolerably good soils, having an adequate supply of available potash (except in the case of No. 69), phosphoric acid, and also of lime and magnesia. In these respects the red soils, as a class, are superior, but the gray soil has on its side the advantage of being more easily tilled, as it is thrifty because of a large percentage of lime, and is generally considered a safer soil. No. 76 is rather deficient in lime, and also in available phosphoric acid. In retentiveness of moisture the upland soil (No. 45½) is a little deficient, and in its composition also it approaches closely to the gray soil.

The soils which most resemble the above are those of the Tennessee valley, in which there are the two varieties of red and gray, bearing to each other about the same relations as are seen in the above analyses. The Tennessee valley soils are, if anything, slightly better than those of the region we are discussing.

In the county descriptions will be found fuller discussions of the qualities of these soil varieties from the farmers' standpoint.

Chazy and Trenton.—The lowermost of the Trenton rocks are impure argillaceous limestones and purer blue limestones, the upper calcareous shales. As a rule, the limestone predominates, and the prevailing soils are, therefore, good strong loams, somewhat calcareous and resembling the soils of the lower part of the dolomite, or those of the Saint Louis group of the sub-Carboniferous. The formation as a whole is valley-making, but the lower beds, which are often aluminous, frequently form low, rounded hills, along the sides of which the strata outcrop in long step-like ledges. In such cases they are usually covered with a growth of cedars.

In the subordinated valleys in the eastern part of the Coosa valley the Trenton rocks are usually associated with those of the dolomite, the latter commonly forming the northwestern and the former the southeastern side of the valley range; but the dolomite, as a rule, far exceeds the Trenton in superficial extent. In the anticlinal valleys the Trenton rocks are found as a narrow belt on each side of the central area of dolomite and shale. In many instances they may be found high along the sides of the ridges of the Clinton or Red Mountain group, even occurring nearly up to the summits of some of them. The outcropping ledges of limestone are then usually covered with a dense growth of cedars, and the name of Cedar mountains commonly given to them is not inappropriate. In the valleys also there are frequent patches of the rocks nearly bare of soil and forming cedar glades. The shaly upper division of this group is of secondary importance.

In Jones' and the other anticlinal valleys the purer limestones of this age are commonly seen outcropping here and there in the lower places in smooth, rounded masses of a bluish color, rising very slightly above the general surface. Very little of the original growth is now standing in those parts of the valleys which have usually been long under cultivation. The soils are brownish sandy loams with yellowish subsoils. The slightly elevated knolls that vary the uniformity in these valleys have sandy soils, and are usually covered with short-leaf pine thickets of secondary growth. There are also spots of low, wet, boggy soil, not at all, however, like the flatwoods before described. The following analysis will show the composition of some soils of this kind:

No. 123. *Sandy brown-loam soil* (Trenton) from 3 miles west of Birmingham, Jefferson county. Depth, 10 inches; vegetation, red and willow oaks, sassafras, and grape-vines—little of the original growth to be seen; color, brown at top, passing into yellow at 3 inches depth.

Sandy brown-loam soil (*Trenton limestone*), *Jefferson county.*

	No. 123.	
Insoluble matter	85.990	90.331
Soluble silica	4.341	
Potash		0.176
Soda		0.028
Lime		0.152
Magnesia		0.116
Brown oxide of manganese		0.041
Peroxide of iron		2.840
Alumina		3.188
Phosphoric acid		0.066
Sulphuric acid		0.051
Water and organic matter		2.532
Total		99.511
Hygroscopic moisture		7.835
absorbed at		24.4 C.°

This is a soil of only average fertility, and probably of little durability, but thrifty and easily tilled.

Clinton.—The rocks of this formation, calcareous sandstones and shales, with beds of red iron ore, yield sandy soils of considerable fertility, but their location on the steep hillsides makes them of little importance in agriculture. The red-ore ridges are in reality made up of three formations: the Clinton, the black shale, and the siliceous division of the sub-Carboniferous. The usual position of these ridges is on each side of the anticlinal valleys of the state, skirting the escarpments of Coal Measures, which form the borders of these valleys. In some places the ridges are duplicated on one side of the valley; but they are never wanting in the positions above indicated (except where ingulfed by a fault), though sometimes quite insignificant in height on one side.

In the western or anticlinal portion of the Coosa valley a red-ore ridge runs parallel with the eastern edge of Lookout mountain, and a similar ridge skirts the western edge of the Coosa coal-fields in the normal positions above mentioned; but in the eastern or faulted portion of the valley the red ridges are not associated with the Coal Measures, but form parts of synclinal basins holding the rocks of the sub-Carboniferous formation. The four localities thus far known of red-ore ridges in the eastern part of the valley are in the Dirtseller and the Gaylor mountains, in Cherokee county, in the mountain near Columbiana, in Shelby, and in the vicinity of Pratt's ferry, in Bibb county. The mountain near Columbiana has along its base a conglomerate which probably underlies the Red Mountain rocks proper and belongs to the Medina group. Where the red ridges are not too steep for cultivation their soils are well adapted to most of the southern crops, especially grain. The analysis which follows shows the average red mountain soil.

No. 68. *Red Mountain soil* (Clinton) from 3 miles north of Springville, Saint Clair county. Depth, 10 inches; vegetation, large poplars, white oaks, and chestnuts, with hickory, black gum, and red oak; color, chocolate-brown when cultivated.

Red Mountain (Clinton) soil, Saint Clair county.

	No. 68.	
Insoluble matter	81.560	85.240
Soluble silica	3.680	
Potash		0.206
Soda		0.037
Lime		0.363
Magnesia		0.279
Brown oxide of manganese		0.214
Peroxide of iron		4.918
Alumina		3.539
Phosphoric acid		0.168
Sulphuric acid		0.088
Water and organic matter		4.330
Total		99.877
Hygroscopic moisture		9.799
absorbed at		27.2 C.°

For the amount of insoluble matter this soil has a fair percentage of potash, a large percentage of phosphoric acid and lime, and is rather above the average in fertility, as might be inferred from the luxuriance of the forest growth which it supports. The Red Mountain soils are admirably suited to the production of small grain, but not for cotton, which is inclined to run to weed, at the expense of the fruit, unless restrained by superphosphates or other similar manures.

The above remarks apply to the red or brown soils only of these ridges, for it must be remembered that they have gray, flinty, gravelly soils usually on one side and the red soils on the other.

The black shale, which follows next after the Clinton, rarely, if ever, takes part in the formation of cultivated soils. It is, at best, only a few feet thick, and as it nearly always occurs in steep ridges it is of comparatively little importance agriculturally.

Sub-Carboniferous.—In the Coosa and outlying valleys of middle Alabama this formation, though occurring only in narrow belts, is of great importance, since it forms the basis of some of the most desirable farming lands in the region of its occurrence.

The surface distribution of the sub-Carboniferous strata is practically the same as that of the red-ore ridges, for, besides forming a part of the ridges themselves, they occupy the depressions between these ridges and the escarpment of the Coal Measures, and in the Coosa valley they form the surface in the four small synclinal basins mentioned in a preceding section. This formation, as a whole, has two well-marked divisions—the mountain limestone and the siliceous. The former, as its name implies, occurs along the sides of the mountains of the Coal Measures, and presents no tracts of arable land in this part of the state.

The lower group, which is generally known as the siliceous, is itself subdivided, and its two parts are very unequally concerned in the formation of tillable lands, for the lowermost or more siliceous division is, as we have seen, usually associated with the Clinton rocks in the formation of the red-ore ridges, which, because of their steep slopes, are not much in cultivation. The upper and more calcareous division of the siliceous group is the true soil-former of these belts. These soils are yellowish, reddish, and brown loams, similar to the soils of the red lands of northern Alabama, which are based upon the same rocks.

The principal discussion of this class of soils will be under the next division in northern Alabama, but the following analysis of a soil from Dry valley, in Cherokee county (basin of the Dirtseller), may serve to represent the composition of the soils of the narrow valleys of middle Alabama:

No. 111. *Red lands soil* (sub-Carboniferous), Dry valley, Cherokee county, 1 mile northeast of Gaylesville. Depth, 8 inches; vegetation, red, post, white, and Spanish oaks, hickory, persimmon, chestnut, black gum, sourwood, dogwood, and a second growth of short-leaf pine; color, reddish-brown.

Red lands soil, Cherokee county.

	No. 111.
Insoluble residue	78.725 } 84.767
Soluble silica	6.042 }
Potash	0.261
Soda	0.124
Lime	0.330
Magnesia	0.395
Brown oxide of manganese	0.215
Peroxide of iron	8.707
Alumina	5.077
Phosphoric acid	0.089
Sulphuric acid	0.097
Water and organic matter	5.150
Total	100.212
Humus	1.365
Available inorganic	1.061
Available phosphoric acid	0.029
Hygroscopic moisture	4.500
absorbed at	26.7 C.°

This soil is somewhat deficient in its retentiveness of moisture, as also in phosphoric acid; otherwise it is a very good soil. The high percentage of lime makes available its whole content of plant-food. The percentage of humus in this soil is also quite high, as well as the proportion of phosphoric acid immediately available.

A fuller exhibition of the characters and variations of these sub-Carboniferous brown loams will be seen under the heading of "The Tennessee Valley Region" (page 28), where they are widely distributed, and are of great importance agriculturally.

The Coosa and Cahaba coal-fields, although occurring in this division, are best described, together with the Coal Measures of the Warrior field, under the next division.

NORTHERN DIVISION.

This division, as already stated, adjoins the first or middle division on the northwest, and embraces most of the state lying north and west of a line drawn from Chattanooga, Tennessee, through Birmingham, nearly to Tuscaloosa. The area thus included is estimated at 9,700 square miles, and embraces the following counties and parts of counties: All of Lawrence, Winston, Walker, Cullman, Morgan, Limestone, and Madison, and parts of De Kalb, Cherokee, Etowah, Jackson, Marshall, Blount, Jefferson, Tuscaloosa, Fayette, Marion, Franklin, Colbert, and Lauderdale.

The two parts into which this division is, by its topographical and agricultural characters, naturally subdivided, are: 1. The continuation and terminus of the great Cumberland table-land, which in Alabama includes the Sand mountain and its outliers, Lookout and Blount mountains, on the south, and the detached spurs lying beyond the Tennessee on the north and the Warrior basin, into which the table-lands of Sand mountain gradually sink beyond the southwestern line of Blount county. 2. The great valley of the Tennessee.

The rock masses which in this division are concerned in the structure of the country and in the production of the soils are referred to two formations, the sub-Carboniferous and the Coal Measures. In some parts of this area the stratified drift overspreads the country rocks and forms the soils, but the drift belt, together with its outreaching marginal parts, which overlap other formations, will be treated as a whole under another head. The approximate horizontality of the strata, and the circumstance that the soils, almost without exception, have been derived from the immediately underlying rocks, have already been commented upon, and the close connection of the agricultural with the geological features has been pointed out. The two component parts of this division are most conveniently described separately.

COAL-MEASURES REGION.

COOSA AND CAHABA COAL-FIELDS.

The Coosa field embraces about 30 square miles in the northwestern part of Calhoun, about 150 square miles in Saint Clair, and about 235 square miles in Shelby county, making an aggregate of 415 square miles.

The Cahaba field includes about 50 square miles in Saint Clair, 100 in Jefferson, 160 in Shelby, and 125 in Bibb county, aggregating 435 square miles. Only 75 square miles in Bibb county are free from drift, so that the area depending upon the Coal Measures for its soil is reduced to 385 square miles.

In both these fields the strata, consisting of sandstones, conglomerates, shales, and coal beds, are tilted at considerable angles, and, possessing varying degrees of resistance of disintegration and erosion, have been very unequally degraded. The main ridges and valleys have the general direction of northeast and southwest, corresponding to the outcrops of the tilted strata; but this uniformity is often greatly obscured, and in places is obliterated by the irregularities produced by the streams which traverse the fields across the outcrops. In the presence of these inequalities, produced by the folding or the tilting of the strata, these fields differ from the great Warrior field, where the topographical features have no such direct connection with the geological structure. All the coal-fields have most of their characters in common; hence a further description of the topography, as well as of the agricultural features, can be well deferred till we come to speak of the Warrior field. It seems to be well established that the three coal-fields of Alabama were once continuous, and that they have been separated by folds (since denuded) and by faults.

THE WARRIOR FIELD.

That part of the Coal Measures of Alabama which is drained by both forks of the Warrior river and their tributaries has received the name of the Warrior coal-field. This field may be divided into two parts: the plateau or table-land, and the Warrior basin proper.

The table-land.—It is characteristic of the table-lands or plateaus that the limestone beds, which underlie the capping of Coal Measures rocks, are above the general drainage level of the country. This arrangement of the two classes of strata determines in great measure the character of the scenery, for the removal by erosion of the more perishable limestones causes the undermining of the harder sandstones above, which from time to time break off with vertical faces, forming cliffs. In height the plateaus diminish continuously toward the southwest, passing gradually into the Warrior basin. In the state of Tennessee their elevation above the surrounding country varies from 850 to 1,000 feet. In Jackson and Madison counties some of the spurs attain an equal height, but further southwest, in Morgan and Marshall, the elevation will not average more than 550, and in Cullman and Blount counties not more than 360 feet, and near the Mississippi line they come down to the drainage level. The main body of the table-land is known as Sand mountain, lying between the Sequatchie fold, or Brown's and Tennessee valleys, on the northwest, and Wills' and Murphree's valleys on the southeast, and include parts of De Kalb, Jackson, Marshall, and Blount counties. The highest parts of this table-land are to be found along its edges overlooking the valleys above mentioned, and there is a general slope both ways toward the center of the plateau, which thus becomes a shallow, elevated trough.

Beyond Wills' valley is Lookout mountain, an outlier of Sand mountain, and beyond Murphree's valley (southeast) Blount mountain, a spur of the main table-land. All these parts have similar structure, and their elevated rims, adjoining the valleys, are usually only slightly indented by the water-courses, except where some large stream leaves the plateau, as in the cases of Little river, on Lookout, and Short creek, on Sand mountain. Northwest of the Tennessee river, however, the tributaries of that stream have cut the elevated lands belonging to this division into a number of more or less isolated peaks, some of which, especially in the northeastern part of the state, have still the capping of Coal Measures, which have been entirely removed from many of those lying farthest toward the west. Overlooking the Tennessee valley, in Lawrence and Franklin counties, the elevated rim, which is locally called Sand mountain, is the border of the Warrior basin, and will be considered along with it.

Approximately, the area of the elevated lands or plateaus as above limited would be about 1,690 square miles on Sand mountain and its spur in Jackson, De Kalb, Marshall, Etowah, Morgan, Saint Clair, and Blount counties, about 290 square miles on Lookout mountain, in De Kalb, Cherokee, and Etowah, about 580 square miles in the detached spurs of the Cumberland northwest of the Tennessee, in Jackson, Madison, and Marshall, and to these might be added about half the area of Cullman county, whose measures partake of the characters of both the table-lands and of the basin, about 295 square miles; aggregating, in all, 2,855 square miles. A not inconsiderable part of this area north of the Tennessee is mountain slope, and is not strictly table-land.

The Warrior basin.—This, like the table-land, is in general a trough, shallow and sloping from northeast to southwest, with slightly elevated rims next to the Tennessee valley on the north and Jones' valley on the south. As Brown's valley divides the plateau, so its continuation southwestward as a ridge divides the basin into two unequal parts. Southwest of the confluence of the two Warriors these two parts seem to come together in one common basin by the sinking away of the ridge which separates them higher up.

The Warrior basin includes all of Walker and Winston and parts of Cullman, Morgan, Lawrence, Franklin, Marion, Lamar, Fayette, Tuscaloosa, and Jefferson counties, and will aggregate about 4,955 square miles. The whole

area of the Warrior field is thus estimated at about 7,810 square miles. (*a*) The surface of the elevated border lands here included is comparatively level, though sufficiently undulating, and in places the streams have cut deep gorges into the hard sandstones and conglomerates. In the basin there is much more inequality of surface, and in the vicinity of streams the country is often extremely rough, although the water-sheds are seldom more than 250 or 300 feet above the general level of the streams. Along the edges of both table-land and basin the higher rims are parts of folds of the strata, and are of sufficient height to determine the direction of the water-courses, and hence the nature of the topography. In the basin there are numerous undulations of the strata, but they are rarely of sufficient importance to affect the topography.

AGRICULTURAL FEATURES.—The Coal Measures present substantially the same characters everywhere as regards soils, but important variations result from differences in latitude and in elevation above the sea. The plateaus seem to be specially suited to the growth of fruits and vegetables and nutritious grasses; but since cotton is the southern crop *par excellence*, neither the plateaus nor the other parts of the coal-fields have hitherto been in good repute as farming lands. As yet, this part of the state is comparatively thinly settled, but its many advantages are gradually being appreciated.

In the discussion of the soil-varieties of the Warrior field reference is also made to those of the other coal-fields, as they are entirely similar. Since the soils of this region are derived from the disintegration of the country rocks, and as these are sandstones, shales, and conglomerates, the agricultural character of the coal-fields is easily understood. All the soils are sandy and more or less deficient in vegetable matter and lime. The subsoils vary from yellowish or reddish clay to sand. The better classes of these soils are light-colored loams, with yellowish or reddish subsoils, and are capable of improvement, since they well retain all fertilizers. The gray soils with light-colored to whitish subsoils, deficient in clayey matter, are too porous and droughty to be profitably cultivated, as they do not retain the fertilizers that may be applied to them.

In the order of their relative importance, both as to surface distribution and agricultural value, the cultivated soils of this region may be classed as follows:

1. *Sandy loams* of gray, yellowish to brown colors, forming perhaps three-fourths of the area. These soils vary between tolerably wide limits, and the natural growth is usually a mixture of various upland oaks, with some hickory and short-leaf pine. The analysis given (No. 110) may be taken as representing the average composition of soils of this class.

2. *Creek-bottom soils.*—These are, according to locality, sandy or loamy, and are generally in cultivation when the proportion of sand is not too great. The bottoms are usually narrow, especially when the surrounding country rocks are hard sandstones or conglomerates. The growth is of oaks, poplar (*Liriodendron*), beech, holly, and occasionally what is known as spruce pine. The more loamy bottom soils are underlaid with a reddish clay (hard), not mixing readily with the surface soil. The sandier varieties have a substratum of sand, and are not altogether so fertile as the preceding; both, however, produce well, are easy of tillage, and are generally under cultivation.

3. *Sandy soils.*—The most highly siliceous sandstones and conglomerates yield, on disintegration, a very sandy soil, which supports a growth of stunted black-jack oaks and short-leaf pines. Such soils are scarcely at all cultivated, and are of little importance agriculturally.

No. 110. *Upland soil*, Sand mountain, near Valley Head, De Kalb county. Depth, 20 inches; vegetation, chiefly red (Spanish) oak, some black oak, short-leaf pine, hickory, dogwood, and chestnut; color, light-gray as far as taken.

Sand Mountain soil (Coal Measures), De Kalb county.

	No. 110.	
Insoluble matter	86.350	90.702
Soluble silica	4.352	
Potash		0.230
Soda		0.141
Lime		0.068
Magnesia		0.154
Brown oxide of manganese		0.070
Peroxide of iron		1.443
Alumina		6.324
Phosphoric acid		0.073
Sulphuric acid		0.062
Water and organic matter		0.844
Total		100.111
Hygroscopic moisture absorbed at 16 C.°		3.368

a Of the 4,955 square miles underlaid by the Coal Measures of the Warrior field, 1,990 are covered with drift deposits, so that only 2,965 of the whole area have soils which are derived from the sandstones, etc., of the Coal Measures. The proportion may be even smaller than this estimate makes it.

The yield of the fresh land at its best, without manures, is estimated at half a bale of cotton to the acre.

From the above analysis it will be seen that the soil contains a large proportion of sand and other siliceous matter (90.7 per cent.), and that there is a notable deficiency of lime and phosphoric acid, with a fair quantity of potash. The soils, therefore, of which this is a representative may be looked upon as rather below the average in fertility; but having usually a good basis of clayey matter they are susceptible of improvement. The agricultural history of this class of soils accords well with the teachings of the analysis, for until quite recently these lands have been almost totally neglected, being deemed comparatively worthless. Recently, however, the use of artificial fertilizers has become general, and it has been found that with a small outlay for phosphates or guano the best results are obtained. These soils are now generally considered the most reliable for cotton, though they are never cultivated without manures.

THE TENNESSEE VALLEY REGION.

Under this head are included not only the immediate valley of the Tennessee river, but also the whole region in Alabama drained by its tributaries, except the anticlinal valley, down which the river flows in Jackson county, and the table-lands of De Kalb, the Cumberland spurs in Jackson, Madison, and Marshall, already described, and the drift-belt in Franklin, Colbert, and Lauderdale counties. With these limits, therefore, this region will embrace an area on both sides of the Tennessee extending from the state line on the north to the Coal Measures of the Warrior field on the south. The average width of this drainage area from north to south is about 45 miles, and includes parts of Jackson, Marshall, Morgan, Lawrence, Franklin, Colbert, and Lauderdale, and all of Limestone and part of Madison counties, aggregating 4,530 square miles. (*a*)

The extreme western parts of Lauderdale, Colbert, and Franklin counties, while falling within the above limits, are best described in another connection, since the soils are derived from the surface beds of drift which there overlie the country rocks.

The general features of this region are those of a plain 12 to 15 miles wide, the Tennessee valley proper, through which the river flows in its tortuous path, the valley being bounded both on the north and on the south by hilly, and in some places almost mountainous, country, and the hills and the valley belonging to the same geological age, the configuration of the whole area being the result of erosion during long geological periods by waters whose present representatives are the Tennessee and its tributaries.

The average elevation of the summits, which represent approximately the general level of the original land surface, is in the eastern part of this region about 2,000 feet above the sea, and there is a gradual slope westward, so that the summits near the Mississippi line are not more than 900 or 1,000 feet above sea-level. The general surface of the lowlands exhibits a similar slope, the elevation at Huntsville being 612 feet, at Courtland 560 feet, and at Dickson 488 feet. The hilly country in the northern part of this area is known as the Barrens, and is a part of the great highland rim of Tennessee. These have generally light-colored siliceous soils, and are not much under cultivation, but they include many tracts with fertile calcareous soils.

South of the Barrens lies the valley proper of the Tennessee, which has usually a fertile calcareous soil of a deep red color. The surface is almost level, the uniformity broken here and there by slight elevations, generally covered with trees and made up of fragments of chert. Upon these wooded knolls are frequently situated the dwelling-houses of the planters. Throughout the whole area sink-holes and caves are common and almost characteristic.

The southern border of the valley is made by the escarpment of the Warrior coal-field, Sand mountain, as it is usually called, rising above the valley to a height which will average, perhaps, 600 or 700 feet. Along the northern face of this escarpment, about half way, is a terrace, or bench, which in the eastern part of Morgan county is very narrow, but widens going westward, and a considerable depression is formed between it and Sand mountain. In Lawrence and Franklin counties this depression is deepened into a valley with calcareous soils (Moulton and Russell's valleys), and the bench, now completely separated from Sand mountain, forms a very conspicuous feature of the landscape, known as the Little mountain range. These valleys have the same general characters as the Tennessee valley, and are partly based on the same rocks. The Little mountain range terminates toward the north with rather bold escarpments, but slopes more gently southward.

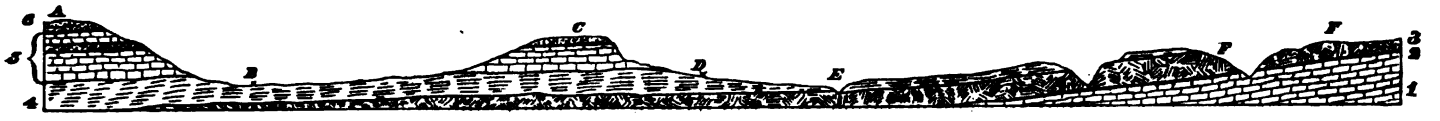
The three divisions of the Tennessee drainage area in northern Alabama are the Barrens, the valley lands, and the Little mountain range, and they divide the surface about as follows: Barrens, 910 square miles; valley lands, 2,430 square miles; and Little mountain range, 540 square miles.

GEOLOGICAL STRUCTURE.—Leaving out of consideration the mountain spurs of the Cumberland range in Jackson and Madison, the anticlinal fold of the Sequatchie in Jackson, and the drift in Lauderdale, Colbert, and Franklin, the surface rocks to which the soils of the Tennessee valley owe their origin belong to a single formation, the sub-Carboniferous, the subdivisions of which, as adopted by the state geological survey, are as follows: Upper: Calcareous—Mountain limestone, or Chester; lower: Siliceous—Saint Louis limestone and Keokuk.

a This represents approximately the whole area in northern Alabama underlaid by sub-Carboniferous strata. Of this, however, some 650 square miles in the western part of the valley are covered with drift, and hence are classed with the short-leaf pine uplands. This leaves 3,880 square miles, in which the soils are based on the sub-Carboniferous rocks.

In addition to the above, the strata of the Devonian and the Upper Silurian formations are exposed along certain creeks in the northern part of this region, but their superficial extent is small, and their part in the formation of the soils insignificant.

The following illustration, taken from the geological report for 1877–'78, and representing a section through the strata from the state line on the north, through Courtland and Moulton, to the Sand mountain on the south, will best illustrate the description below, and will make clear many of the circumstances affecting the distribution of the various agricultural features of the Tennessee valley:



SECTION ACROSS THE VALLEY OF THE TENNESSEE IN NORTHERN ALABAMA.

EXPLANATIONS.—1, Silurian; 2, Devonian; 3, Lower Siliceous; 4, Upper Siliceous; 5, Mountain limestone; 6, Coal Measures; A, Sand mountain; B, Moulton; C, Little mountains; D, Courtland; E, Tennessee river; F, Barrens. Scale.—Horizontal, 1 inch to 6 miles; vertical, 1 inch to 1,000 feet.

LITHOLOGICAL CHARACTERS, DISTRIBUTION, ETC.—1 *and* 2. *Silurian and Devonian.*—These two formations, which are composed of limestones and shales, are exposed only in the bluffs of streams which drain the northern part of this area, and which have their sources within the Tennessee line. The slight dip of the strata brings these beds within the reach of the denuding waters in the north, while farther south they pass below the overlying beds, as may be seen in the illustration. As stated, they are of no consequence from an agricultural standpoint, because of their very limited occurrence in Alabama, except along the borders of Elk river, in Limestone county, where they form some bodies of very good land.

3. *Lower Siliceous.*—These beds are supposed to be equivalent to the Keokuk and Burlington beds of other states and to the Barrens group of Tennessee. The most important rocks of the formation are highly siliceous limestone, alternating with a pure crystalline limestone, admirably suited to architectural purposes, and impure shaly limestones. The resistance to erosion offered by the flinty material with which a large proportion of the limestones are impregnated gives rise to the broken, rugged surface which characterizes so much of the Barrens. The whole thickness of the formation is about 300 feet, in which, 100 feet below, are the purer limestones, and 200 feet above are the more siliceous beds. The distribution of these beds as surface rocks is coextensive with that of the Barrens, as shown on the map.

4. *Upper Siliceous.*—This is the equivalent of the Saint Louis or coral limestone group, and is in many respects the most important of the formations occurring in northern Alabama, for from it are derived most of those soils which have made the valley of the Tennessee one of the best farming areas of the state. The rocks are, as a whole, cherty limestones, usually highly fossiliferous, and sometimes argillaceous. The chert of this division is generally easily recognized, being found in nodular masses filled with impressions of fossils. The country where this formation appears as surface rock is generally level, with low knobs, formed of fragments of chert, remnants of the cherty portions of the limestone. These chert masses are sometimes much decomposed, weathering occasionally to a white chalky-looking siliceous powder.

The soil over the Saint Louis limestone is usually colored deep red and orange by the hydrated oxide of iron with which it is impregnated, and this material is occasionally found in such quantity as to form regular ore banks (limonite). The limestones of this formation appear to have suffered subterranean erosion to a greater extent than those of any other, except, perhaps, the dolomite of the middle Alabama anticlinals. As a consequence, sink-holes, caves, underground streams, and big springs become almost characteristic of the Saint Louis group. The average thickness of the group in northern Alabama may be put at 150 feet, and its distribution as the surface rocks may be seen on the map, marked by the color of the red and valley lands, the greater part of which have been derived from it.

5. *Mountain limestone.*—This uppermost or calcareous member of the sub-Carboniferous formation, which is considered as an equivalent of the Chester group of other states, is composed of limestones and shales, with one bed of sandstone included. Its thickness in the eastern part of the valley, as for instance near Huntsville, is between 650 and 700 feet; but westward it thins down, being in Lawrence and Franklin counties seldom more than 150 or 200 feet. The characters of the rocks change also with the locality, for near Huntsville they are mostly limestones, the sandstone stratum being quite thin. In Lawrence, Colbert, and Franklin counties the limestones thin out, while the sandstone becomes prominent, having often a thickness of 75 feet. In these western counties also the sandstone bed is often duplicated, its two parts being separated by limestones.

The calcareous beds of the mountain limestone, as the name implies, are mostly found among the slopes of the Cumberland spurs in Jackson and Madison and along the slopes of the escarpment of Sand mountain in Morgan, Lawrence, and Franklin counties, and also along both the northern and southern slopes of the Little mountains in Morgan, Lawrence, Colbert, and Franklin. In addition to these localities, many of the valleys between the Cumberland spurs in Jackson and Madison and of the rich coves which indent the northern edge of the Sand mountain in Morgan, Lawrence, and Franklin counties are based upon these limestones. The sandstone bed, on

the other hand, is found as the surface rock of the terrace or bench which so generally occurs along the sides of the Sand mountain and of the Cumberland spurs, capping many of the smaller spurs in Jackson and Madison; and also at the summit of the Little mountains, which is only a remnant of this once wide terrace, now isolated from the main body by the cutting out of a valley between. Where the streams have cut through these mountains they flow generally through deep gorges or cañons with perpendicular sides, the sandstones forming the top rock, with the limestones below. The sandstone, being undermined by the wearing away of the underlying calcareous beds, breaks off, leaving perpendicular cliffs.

The character of the topography and the distribution of the mountain limestone beds will be easily inferred from the above remarks, and it is perhaps only necessary to state that some of the valleys and gaps separating the mountain spurs in the extreme east of this region are based, in part, upon the calcareous portions of this formation, which in such cases extend out to some distance from the base of the mountain.

AGRICULTURAL CHARACTERS.—*The Barrens.*—Based upon the rocks of the Lower Siliceous group, the Barrens occur in greatest force in the northern part of the state near the Tennessee line, in the counties of Madison, Limestone, and Lauderdale. In the valley, or red lands, occasional spots of barrens are exposed by the removal by denudation of the overlying rocks, and this is particularly the case in the vicinity of the Tennessee river itself, where the drainage has cut deepest. On the other hand, occasional spots of red lands may be found occupying the summits of the elevations in the Barrens, and thus, while the general line of separation of the two land varieties may be laid down with some accuracy, nothing short of extended exploration would enable one to mark out their precise limits. The whole area of the Barrens has been estimated at 910 square miles, of which 150 are in Madison, 400 in Limestone, and 360 in Lauderdale.

As a part of the highland rim of Tennessee, the Barrens may be described as a high plain, having an average elevation of perhaps 700 or 800 feet above the sea, with a general slope from the east toward the west and a special slope southward, caused by the drainage of the Tennessee river. The highest lands are in general near the state line on the north. Into this high land the streams have cut their channels, which, as a rule, are quite deep and narrow. Going southward, these indentations of the elevated plain become more numerous and widen out, the flat dividing lands narrow down, and near the larger streams become more or less rounded ridges, which are cut up by the smaller tributaries into a number of detached hills. These river hills, though often very steep, have good soils, and are generally in cultivation. Strips of the barren lands extend out into the valley lands along most of the larger streams, in some places coming down to the Tennessee itself. The western part of Lauderdale is perhaps the most broken of any of the barren lands in Alabama.

The two principal soil varieties of the Barrens are derived from the upper and lower rocks of the formation, respectively. The uppermost rocks are highly siliceous limestones, which form the surface over the greater part of this division and have given it its characteristic topographical and agricultural features, the lower beds, which are often pure limestones, being exposed chiefly in the larger creek valleys, and southward in the lowlands of the river. The disintegration of the siliceous rocks above named gives rise to the most widely distributed and characteristic class of Barrens soils, which are light-colored, whitish to gray sandy loams, having a reddish or yellowish siliceous subsoil, which, in turn, rests upon a hard-pan impervious to water at a depth of three to five feet. The Barrens land, like some of the Sand Mountain land already spoken of, was formerly considered almost worthless for farming purposes, but has been coming rapidly into favor of late years. It has been found that by the use of, say, 200 pounds of guano to the acre this land gives a fine yield of cotton. The main difficulty with cotton is in keeping a stand of the young plants in the early spring, as on account of the impervious hard-pan underlying the subsoil the land is often badly drained and the young plants are "scalded", and thus killed. A drain of less than four feet depth is generally useless. The subjoined analyses will show the general character of the Barrens soil:

No. 40. *Barrens soil* from near Cluttsville, Madison county, collected by Thomas B. Kelly. Depth, 8 inches; vegetation, post, black, red, Spanish, and black-jack oaks, scrub hickory, wild gooseberry, blackberry, winter huckleberry, and a coarse grass, good for sheep and cattle; color, yellowish-gray. This soil is easily cultivated, and, when properly drained, produces well. It was formerly timbered with chestnuts, since disappeared. After rains the soil hardens, thus preventing the growth of cotton till broken up with a plow.

No. 48. *Barrens soil* from near Huntsville, Madison county, collected by Colonel W. C. Irwin. Depth, 6 inches; vegetation, scrubby post and black oaks, a few hickories and dogwoods; no grass, but a thick undergrowth of dogwood bushes; color, light yellowish-gray; change of tint at 3½ inches, clay at 7 inches.

Barrens soils (sub-Carboniferous), Madison county.

	Cluttsville soil.	Huntsville soil.
	No. 40.	No. 48.
Insoluble matter	89.950 } 92.242	84.160 } 88.720
Soluble silica	2.292 }	4.560 }
Potash	0.255	0.116
Soda	0.064	0.025
Lime	0.064	0.041
Magnesia	0.035	0.159
Brown oxide of manganese	0.150	0.041
Peroxide of iron	1.695	2.705
Alumina	3.292	4.597
Phosphoric acid	0.100	0.054
Sulphuric acid	0.178	0.045
Water and organic matter	2.094	3.388
Total	100.099	99.891
Hygroscopic moisture	4.450	4.785
absorbed at	21 C.°	28 C.°

These analyses show a large percentage of insoluble matter and a deficiency of lime and vegetable matter. The hardening of No. 40 is probably due to this lack of organic matter. In potash and phosphoric acid, considering the amount of insoluble matter, there is a sufficiency in the case of No. 40. Neither soil has much capacity for retaining moisture. These soils, like those of the Coal Measures, chemically somewhat similar, have generally a good foundation of clay, and are therefore capable of improvement.

Within the limits of the Barrens there is a class of soils making what are called the gravelly bottom lands. These are gravelly loams of gray to yellow or brown colors, resting on somewhat heavier, yellowish-red subsoil. The river hills along the Tennessee in some localities are apparently of a somewhat similar nature.

No. 52. *Gravelly soil*, Limestone creek bottom, near Cluttsville, Madison county, collected by Thomas B. Kelly. Depth, not given; vegetation, poplar, beech, sugar-maple, sycamore, gum, walnut, red, white, and black oaks; color, light-brown; a somewhat difficult soil to till because of the gravel.

No. 56. *Gravelly or river-hills soil*, one-fourth of a mile south of the Tennessee river, near Tuscumbia, Colbert county, collected by B. Pybas. Depth, 4½ inches; vegetation, red, white, and black-jack oaks, dogwood, white poplar, and small scrub-walnut; color, gray with shade of yellow; subsoil, dark ocher, reaching to 2 feet depth.

Gravelly-bottom and river-hills soils, Barrens (sub-Carboniferous).

	MADISON COUNTY.	COLBERT COUNTY.
	Limestone creek bottom.	Tennessee river hills.
	No. 52.	No. 56.
Insoluble matter	79.005 } 85.028	79.320 } 86.080
Soluble silica	6.023 }	6.760 }
Potash	0.270	0.309
Soda	0.161	0.067
Lime	0.182	0.398
Magnesia	0.224	0.226
Brown oxide of manganese	0.239	0.324
Peroxide of iron	2.871	2.969
Alumina	4.834	4.771
Phosphoric acid	0.269	0.153
Sulphuric acid	0.010	0.172
Water and organic matter	5.758	4.458
Total	99.786	99.927
Humus	1.974	.....
Available inorganic	0.860	.....
Available phosphoric acid	0.073	.....
Hygroscopic moisture	6.881	5.371
absorbed at	9.4 C.°	28.3 C.°

These analyses indicate soils of a fair degree of fertility and durability, which, while they contain a large proportion of insoluble matter, are yet thrifty, by reason of a comparatively large percentage of lime and magnesia. In productiveness they stand much nearer the red lands than the Barrens, the average seed-cotton product per acre being given at from 800 to 1,200 pounds, while that of the Barrens will probably not average more than from 500 to 700 pounds. Perhaps less than 10 per cent. of the cultivated land of the immediate valley of the Tennessee is of this kind.

To recapitulate, until quite recently the great proportion of cultivated lands of the valley of the Tennessee were red limestone lands. Of late, however, the lighter and more siliceous soils of the Barrens have been found to be profitable soils to cultivate, especially with artificial fertilizers, and these are now preferred by many, as they are safer and easier of cultivation. The cotton staple from these lands is less likely to be stained or otherwise injured than that from the red lands.

The limestones which make the lower part of the formation yield a red or brown-loam soil, and is in most respects similar to that of the red lands of the valley. Of this no analyses have been made. This soil is confined to the borders of the streams which traverse the highlands, and, while of much better quality than the average soil of the Barrens, is of limited occurrence.

The red or valley lands.—Under this head are included the valley proper of the Tennessee, extending from the Barrens on the north to the Little mountains on the south, the valley lying between the Little mountain range and Sand mountain, and the valleys and gaps separating the spurs of the Cumberland in the eastern part of this division, which are all closely related in their agricultural and topographical features. The area is estimated at about 2,430 square miles, of which 320 are in Jackson, 460 in Madison, 190 in Limestone, 240 in Lauderdale, 210 in Franklin, 150 in Colbert, 480 in Lawrence, 285 in Morgan, and 95 in Marshall counties. In this estimate are included also those calcareous lands derived from the limestones of the mountain limestone formation where they occur in the valleys and not upon the mountain slopes.

The general character of the valley lands has already been alluded to. They are nearly level or gently undulating, especially near the Tennessee river, on both sides; but in the gaps between the mountain spurs the surface is more broken. On account of the fertile nature of the soil most of these lands are cleared and under cultivation, but the monotony is agreeably relieved by the low knolls, which are covered with a luxuriant growth of oaks. These knolls are formed by the accumulation of the siliceous parts of the limestone, and, being too rocky for easy cultivation, are often chosen as sites for the dwelling-houses of the planters. Where the flaggy limestones, either of the Saint Louis or of the mountain limestone group, lie very near the surface, with but a thin coating of soil, they are usually covered with a dense thicket or glade of red cedar. Sink-holes and big springs are numerous throughout the valley.

The Saint Louis or coral limestone has been described as a siliceous limestone, and in its disintegration it yields a soil which, while varying between wide limits, is in general terms a sandy loam, resting upon what is usually called red clay, but which is a heavy loam, containing from 2 to 8 per cent. of ferric oxide and about an equal proportion of alumina. The soil varies in color from mulatto to deep-red and nearly black, according to the proportions of the several ingredients. The following analyses of soils of this character from different localities will show well the variations in the quality, as well as the average composition of these lands:

No. 38. *Red lands soil* from near Cluttsville, Madison county, collected by Thomas B. Kelly. Depth, 11 inches; vegetation, hickory, poplar, ash, red, black, and white oaks, chestnut, walnut, elm, cedar, black haw, dogwood, etc.; color of the soil, dark-brown; of the subsoil, yellowish-brown. In its physical properties this soil is very friable. Water sinks rapidly into it, and is retained by the subsoil.

No. 34. *Red lands soil* from 1 mile east of Tuscumbia, Colbert county, collected by B. Pybas. Depth, 10 inches; vegetation, black-jack, red, and post oaks, hickory, and scrub cedar; no undergrowth; color, dark-brown to nearly black. This soil after rains tends to form a crust, which, if not broken up, becomes nearly as hard as a rock.

No. 64. *Red lands soil* from Russell's valley, near Russellville, Franklin county, collected by Dr. Daniel Sevier. Depth, 15 inches; vegetation, red, black, white, post, and black-jack oaks, cedar, dogwood, chestnut, walnut, wild cherry, and black locust; color, dark-brown, passing to a lighter reddish-brown in the subsoil.

Red soils, Tennessee valley (sub-Carboniferous).

	Madison county.	Colbert county.	Franklin county.
	Cluttsville.	Tuscumbia.	Russellville.
	Red lands soil.	Red lands soil.	Red lands soil.
	No. 38.	No. 34.	No. 64.
Insoluble matter	77.950	76.023	75.360
Soluble silica	5.343	8.995	5.237
	83.293	85.018	80.597
Potash	0.243	0.276	0.154
Soda	0.058	0.133	0.110
Lime	0.648	0.267	0.250
Magnesia	0.058	0.381	0.250
Brown oxide of manganese	0.103	0.218	0.138
Peroxide of iron	2.873	5.230	5.623
Alumina	6.198	5.691	8.163
Phosphoric acid	0.188	0.151	0.229
Sulphuric acid	0.025	0.020	0.039
Water and organic matter	6.620	1.794	4.100
Total	100.307	99.179	99.653
Humus	2.242	0.700	.....
Available inorganic	1.551	0.956	.....
Available phosphoric acid	0.109	0.020	.....
Hygroscopic moisture	9.760	8.840	6.14
absorbed at	21 C.°	7.8 C.°	26.7 C.°

Since the immediate fertility of a soil depends upon the available phosphoric acid and other inorganic plant-food, the humus determinations should give us an insight into the capabilities of a soil with reference to the next succeeding crop.

The analyses show that all these soils are of rather more than average fertility; and while they do not contain unusually large amounts of phosphoric acid and potash, yet the large percentage of lime in each case renders the soil thrifty. In comparing No. 38 with No. 34 the latter is seen to be notably deficient in vegetable matter, to which may probably be ascribed its tendency to bake hard after rains. In the percentage of humus, also, they differ widely, as also in the amount of available phosphoric acid, which in No. 38 is 0.109, and in No. 34 only 0.020 per cent. All three soils have fair capacity for retaining moisture.

The creek-bottom lands in the Tennessee valley are of varying degrees of fertility, but are generally productive, since they contain the best parts of the uplands which surround them.

Upon the sides of the mountain spurs in Jackson, Madison, Marshall, and Morgan counties, and also along the base of the Little mountain range, the calcareous parts of the mountain limestone yield a stiff clayey and limy soil, which supports a fine growth of forest trees, but which, on account of their position on the mountain slopes, are not well suited to cultivation. But there are many places in the counties named where this soil is found in sufficiently level position to be profitably cultivated, and in many of the rich coves which penetrate the edges of the mountains these are the prevailing soils. No analyses have been made, but the crops produced show that they are in character somewhat like the red valley soils, though not so generally of red colors. The prevailing color is gray to black, and there are spots of black soil that recall in appearance the black prairie soils of the south, to be found in places on Little mountains and other localities made by this formation.

The Little mountains.—This well-marked feature of the Tennessee valley has already been alluded to and its principal characters given. The Little mountains proper extend from Morgan, through Lawrence and Colbert counties, out to the Mississippi line. In Madison and Jackson counties there are many small and detached spurs which have exactly similar structure to that of the main body, and they are to be considered in the same connection. All these spurs, and the Little mountains themselves, owe their existence to a stratum of sandstone in the mountain limestone or Chester group, which has protected them against the erosion that has wasted away the adjacent lands on all sides. From the approximately horizontal position of the strata the summits of these mountains are mostly rather level, though worn into slight depressions here and there. As a general thing these lands are not much under cultivation, since the soil derived from the sandstones is not rich, and scarcely pays to cultivate.

The northern face of these mountains is usually steep and abrupt and somewhat indented with fertile coves having red and brown-loam soils. The southern slope is much more gradual. Where the sandstone has been removed the underlying calcareous rocks of the formation come to the surface and give rise to the so-called prairies, which are destitute of trees, because of the thinness of the soil and the proximity of the rock to the surface. Such

places furnish, however, excellent pasturage. The prairie spots are generally found on the summit or southern slope of these mountains, but along their northern or steep face there is very often seen a level bench, or terrace, with the stiff, limy soils of this character.

On account of their elevation and pleasant climate the Little mountains are favorite places of residence, and several towns are situated upon them, among which may be mentioned Somerville, Mountain Home, La Grange, etc. Where streams have cut across the Little mountains they flow through deep gorges with almost perpendicular sides, and underneath some of the sandstone ledges often spring chalybeate and other mineral waters. The area occupied by the Little mountains and similar elevations is estimated to be about 540 square miles, of which 50 are found in the detached spurs of Madison county, 140 in Morgan, 150 in Lawrence, 170 in Colbert, and 30 in Franklin.

Soils.—The agricultural features of the mountain spurs here included are, as might be supposed, rather uniform. The sandstone, which forms the greater part of the surface, yields a sandy soil, which is closely like the prevailing soil in the Coal Measures. Its chief timber also resembles that of the coal regions, consisting of Spanish, post, and white oaks, with some short-leaf pine. Other trees are common in some places, as chestnuts and hickories.

The following analysis of a soil collected on Little mountains near the old town of La Grange, in Colbert county, will serve to show the general nature of these lands:

No. 36. *Little Mountain soil* from La Grange, near Tuscumbia, in Colbert county, collected by B. Pybas. Depth, 8 inches; vegetation, chestnut, short-leaf pine, hickory, post oak, and small sourwood; color, top soil dark brown 2 inches; below that yellowish sand at 2 feet, and at 5 feet solid sandstone rock.

Sandy soil of Little mountains, Colbert county.

	No. 36.	
Insoluble matter	93.630	95.312
Soluble silica	1.682	
Potash		0.100
Soda		0.060
Lime		0.120
Magnesia		0.040
Brown oxide of manganese		0.102
Peroxide of iron		0.761
Alumina		1.532
Phosphoric acid		0.051
Sulphuric acid		0.028
Water and organic matter		2.055
Total		100.161
Hygroscopic moisture		1.56
absorbed at		25.6 C.°

A rather poor soil, like that of the Coal Measures generally, but with a larger proportion of lime and of organic matter and less of potash.

SOUTHERN DIVISION.

All that part of the state south and west of the limits of the middle and northern divisions is embraced in the southern division, which includes the whole or parts of Lauderdale, Colbert, Franklin, Marion, Lamar, Fayette, Tuscaloosa, Bibb, Chilton, Elmore, Tallapoosa, and Lee counties, and all of Pickens, Greene, Hale, Sumter, Choctaw, Marengo, Dallas, Perry, Autauga, Lowndes, Montgomery, Macon, Bullock, Russell, Barbour, Pike, Crenshaw, Butler, Wilcox, Monroe, Clarke, Washington, Mobile, Baldwin, Escambia, Conecuh, Covington, Geneva, Coffee, Dale, and Henry. The area of this division is approximately 32,335 square miles.

GENERAL GEOLOGICAL AND TOPOGRAPHICAL FEATURES AND SUBDIVISIONS.—The Cretaceous and Tertiary rocks which underlie this whole division are approximately horizontal in stratification, but have a slight dip toward the south and southwest. With the exception of part of the prairies, presently to be described, the whole area is covered with beds of drifted material which have been deposited upon an eroded surface of the older rocks. The drift-beds are, as a rule, very irregularly stratified.

It may thus be inferred that the minor details of surface configuration and the soils are, to a certain extent, independent of the underlying older rocks, and are in great measure determined by these drifted materials. In these respects this division differs from the two preceding ones. But while it depends to so great an extent for its soils and topography upon a single formation, there is not in these the great monotony that might be

looked for on this account. The drift itself is composed of materials which offer varying degrees of resistance to denudation, and considerable inequalities of surface result from this circumstance. In addition to this, the older rocks had been greatly eroded before they were covered by the drift, so that the general contour of the country, as well as many of the most prominent topographical features in this division, are quite independent of the superficial drift-coating which determines so many of the minor details.

The low trough of the prairie region, the rugged hills of the buhr-stone, and the gently undulating surface of the southern pine belt were features of the landscape before the deposition of the drift; and similarly with the soils the drift itself yields a number of varieties, which are still further increased by the modifications brought about by their intermixture with the disintegrated portions of the underlying country rocks. These rocks are referred to two principal formations, the Cretaceous and the Tertiary. For convenience of reference I give in condensed form the most important subdivisions of these formations, together with their lithological and other characters in so far as they are of importance in determining the agricultural features.

TERTIARY.—*Vicksburg* (uppermost).—The chief material is a soft white limestone (containing *Orbitoides Mantelli*), easily cut with an ax or a saw into blocks, which are used throughout the region of its occurrence in the construction of chimneys. This alternates with whitish shell marls, and occurs over a belt of country from 30 to 50 miles wide north and south, the lower half of which is gently undulating, the upper somewhat broken and hilly. The whole region is covered with beds of later age, which, in most cases, form the soils.

Jackson.—An impure limestone or calcareous clay of a light, nearly white color, containing grains of greensand, is the chief material of this formation in Alabama. Its thickness is from 40 to 50 feet, and in some places it is underlaid with fossiliferous sands and with ten feet or more of grayish laminated clays. The disintegration of the principal stratum gives rise to the calcareous prairie soils of the lime-hills, whose surface distribution is the same as that of the northern half of the Vicksburg. Like the preceding, the strata of this group are generally covered with beds of a more recent formation, which form the greater part of the soils, and in great measure determine the topography; yet where these overlying beds have been partially removed the characteristic soils and no less characteristic topography of the lime-hills are produced.

Claiborne.—The materials of this division consist of sandy shell deposits, alternating with impure whitish limestones or calcareous clays containing greensand. These deposits are exposed along ravines and bluffs, but seldom form the surface over any considerable area, and have comparatively little effect upon the soils beyond making them locally more fertile. These beds may be observed at the lower levels throughout the territory above assigned to the Jackson group.

Buhr-stone.—Siliceous sandstones and claystones make up the greater part of this division. These deposits form a line of rocky hills extending nearly across the state. In general, the soils are extremely poor; but there are limited areas of more fertile character, due to the influence of the calcareous beds, with which the prevailing materials are sparingly interstratified.

Lagrange or Lignitic.—Grayish or dark-colored laminated clays and yellowish or gray sands, containing several beds of lignite and alternating with beds of greensand marl. These materials form the substratum of a belt 15 or 20 miles in width, the soils of which are mostly derived from the superficial beds of drift, except where the marl beds, especially along the southern border of this division, give rise to highly fertile lime-hills, closely resembling those of the Jackson group.

Flatwoods.—The chief strata are "massy" or thick-bedded joint-clays of gray or darker colors, and of tolerably uniform character. The soils are heavy and clayey, seldom tempered to any considerable degree by the sandy beds of the drift. The timber is mostly post oak.

CRETACEOUS.—*Ripley.*—Hard crystalline and often sandy limestone and bluish, micaceous, frequently highly fossiliferous marls make up the greater part of this division. The blue marl has its best development in the eastern part of the state. The interstratification of the hard limestone with the softer marls gives rise to the rugged topography of the hill prairie region. The larger proportion of the soils over this division are derived from the drift, with local modifications due to the influence of the marls and limestone, while occasionally the soils are derived almost wholly from the Cretaceous material.

Rotten limestone.—An impure argillaceous limestone of great uniformity of composition over wide areas is the characteristic material of this division. The surface is gently undulating, and the soils are derived partly from the simple disintegration of the limestone and partly from admixtures of this with the loam of the drift. This rock underlies a belt of country averaging 15 or 20 miles in width, and is noted for its fertility.

Eutaw.—The chief materials of the Eutaw group are gray laminated clays, irregularly bedded sands, containing some mica, and having often a greenish cast, partly from grains of greensand and partly from some substance coating the siliceous sand grains.

Subordinated to the above are beds of lignite and lignitized trunks of trees. The soils over the whole area are derived from the overlying drift, except along the sides of ravines, etc., where the above-named materials are uncovered, giving rise to small tracts of more than average fertility, which lie, however, usually on such steep slopes as to be of little agricultural value. The stratigraphical relations of these formations are shown in sufficient detail in the general section given on page 13.

Taken as a whole, the surface of the southern division has a general slope from the margin of the two divisions just described outward, *i. e.*, west and south toward the Mississippi basin and the Gulf of Mexico. This general slope is interrupted by the trough of the central prairie region, which is depressed many feet below the general level both north and south of it, and also on a limited scale by the trough of the flatwoods. South of the prairie belt there is a line of rocky hills made by the hard sandstones and claystones of the lower part of the Tertiary formation, beyond which, toward the south, the country falls away very gradually and uniformly to the coast.

Mention has been made of the differences existing in the materials of the drift formation overlying the most of this region. These materials are pebbles, sands, and a red, brown, or yellow loam, and the geographical distribution of these several materials, taken in connection with other physical conditions, lies at the basis of the classification of this division into its agricultural regions.

Around the outer margin of the two preceding divisions there is seen a great accumulation of these drift beds, so great as to hide completely from view over areas of considerable size all the underlying rocks of the country. Along this belt pebbles of quartz and chert and beds of red and brown loam are seen in their greatest thickness. As we go outward from this belt the pebbles become less and less abundant, and seem to be confined to well-defined channels, along which, however, they may be traced for great distances, even into Florida, but they cease to be characteristic beyond a comparatively narrow belt. The loam also appears to decrease in thickness and prominence in the same directions, though it is found generally distributed much farther south than the pebbles.

The whole region over which the red and brown loams prevail has many topographical and botanical features in common, prominent among which are the broken and hilly surface and the mixture with pines of oak and hickory in the forest growth. Southward from this region of mixed growth the long-leaf pine is the most characteristic and constantly occurring tree, and gives the name to a second region, which reaches to the Gulf of Mexico.

The subdivisions of the region of mixed growth are based primarily upon the species of pine which is associated with the other trees, it being the short-leaf pine in the one case and the long-leaf in the other. Other subdivisions of this region depend on the relative proportions of long-leaf pine and other timber trees.

The region of the long-leaf pine is subdivided, in accordance with the prevailing topographical character, into hilly, rolling, and flat lands.

The black-prairie region, the flatwoods, and the lime-hills are agricultural regions, in which the soils are to a great extent dependent on the rocks of the country for their formation, and do not properly find a place in the two regions as just defined.

In accordance with the characters given, the southern division may be divided into the following agricultural regions or subdivisions:

1. *The Oak and Pine Uplands Region*, including—
   - The oak and hickory and short-leaf pine uplands.
   - The gravelly hills, with long-leaf pine.
   - The oak and hickory uplands, with long-leaf pine, including brown-loam uplands and long-leaf pine uplands.
2. *The Central or Upper Prairie Region*, with its three features of—
   - Black prairie or "canebrake".
   - Hill prairie or Chunnenugga ridge.
   - The blue marl lands.
3. *The Post-oak Flatwoods.*
4. *The Lower Prairie or Lime-Hills Region*, including the shell prairies and red-lime lands.
5. *The Long-leaf Pine Region*, with its subdivisions—
   - Long-leaf pine hills.
   - Rolling, open pine woods and lime-sink region.
   - Pine flats.
6. *The Alluvial Region of Mobile River and the coast marshes.*

From the nature of the forest growth, as outlined in the above agricultural subdivisions, it may be inferred that the prevailing soil varies with the geographical position, and in fact we find that the surface soil increases in sandiness as we go southward toward the Gulf. In addition to this, local variations in the predominant soil of all the regions just enumerated arise from the varying quality at different depths of these superficial beds of loam and drift. To illustrate this a series of specimens was taken near the city of Tuscaloosa down to the depth of 14 feet, passing through the red loam and into the underlying sand and pebble beds.

No. 115. *Soil*, brownish-red color, taken to the depth of 5 inches.

No. 116. *Subsoil*, clayey loam, of a deep-red color, taken from 5 to 18 inches.

No. 117. *Under subsoil*, more sandy, and of same deep-red color, taken from 18 inches to 3½ feet.

No. 118. *Red, sandy loam*, taken from 3½ to 7½ feet.

No. 119. *Reddish sandy loam*, increasing in sandiness with the depth, and becoming yellowish in color; taken from 7½ to 9½ feet.

No. 120. *Yellowish, coarse sand*, taken from 9½ to 14 feet. The preceding bed gradually passes into this.

No. 121 is *a bed of pebbles with sand*, irregularly stratified, and of variable thickness and quality, extending to the bottom of the gully, say from 14 to 45 feet. This has not yet been analyzed.

No. 122. *Gray clay, with a few specks of red.* This was an irregularly-shaped bed near the bottom of the section.

These specimens were analyzed by Mr. D. W. Langdon, jr., of Mobile, a student in my laboratory, with results as given below:

Analyses of brown-loam soil, with subsoil, and the underlying beds, down to the depth of 14 feet; also, analysis of gray clay, Tuscaloosa.

	Soil brownish-red to depth of 5 inches.	Subsoil deep-red from 5 to 18 inches.	Under subsoil deep-red 18 inches to 3½ feet.	Red, sandy loam, more yellowish than preceding, 3½ to 7½ feet.	Red, sandy loam, becoming yellowish below, 7½ to 9½ feet.	Yellowish, coarse sand, 9½ to 14 feet.	Gray clay, with a few specks of red, bottom of gully.
	No. 115.	No. 116.	No. 117.	No. 118.	No. 119.	No. 120.	No. 122.
Insoluble matter	81.683	84.777	91.493	88.989	96.405	98.370	81.837
Soluble silica	0.465 } 82.148	0.656 } 85.433	0.066 } 91.550	1.827 } 90.816	0.687 } 97.092	0.086 } 98.456	0.256 } 82.093
Potash	0.255	0.205	0.150	0.139	0.005	0.005	0.256
Soda	0.175	0.175	0.140	0.135	0.004	0.003	0.197
Lime	0.140	0.065	0.071	0.045	0.006	0.004	0.341
Magnesia	0.097	0.100	0.005	0.004	0.002	0.001	0.194
Brown oxide of manganese	0.102	0.099	0.066	0.061	0.003	0.002	0.010
Peroxide of iron	4.184	4.903	2.495	2.592	1.910	0.717	0.576
Alumina	7.081	6.278	3.466	3.998	0.786	0.454	11.814
Phosphoric acid	0.090	0.086	0.007	0.007	0.003	0.001	0.001
Sulphuric acid	0.025	0.083	0.071	0.066	0.004	0.004	0.150
Water and organic matter	5.425	2.288	1.987	1.791	0.841	0.752	5.140
Total	99.722	99.715	100.017	99.654	100.656	100.399	100.272
Hygroscopic moisture	6.305	7.275	5.647	4.103	3.996	0.290	.....
absorbed at	18 C.°	18 C.°	19 C.°	18 C.°	18 C.°	19 C.°	.....

These analyses show very clearly the gradual decrease in the percentages of potash, lime, magnesia, and phosphoric acid, and consequent deterioration of the soil-forming qualities of the beds as the depth from the surface increases, and a similar decrease in the capacity for moisture in the same direction. The prominent points of difference between the loam and the drift sands are best seen on comparing Nos. 118 and 120, since No. 119 forms a transition between the two. This transition bed (No. 119) shows how the lower parts of the loam and the upper parts of the underlying drift shade off into each other without there being any sharp line between, and yet within 2 feet the change from loam to sand is complete.

From the analyses we can also easily account for the fact, so often to be observed in the parts of the state where these beds make the surface, that along many of the slopes of the loam-covered table-lands we find a forest growth entirely different from that of the plains above and denoting a great deterioration in the quality of the soil. A removal by denudation of the loam will expose the greatly inferior sands and cause a corresponding change in the character of the soil. Many of the poor pine ridges which traverse the areas of better land have had this surface loam in great measure removed. On the other hand, the sandiness of the soils of some of the table-lands finds its explanation in the fact that on such level lands the surface materials are not washed off bodily, but the finer clayey particles are carried by the percolating water deeper from the surface, leaving the coarser sand above. In most cases of this kind the surface soil is usually much more sandy than its subsoil.

The specimens of which the analyses are given were taken from a slope where both the finer clayey and the coarser sandy particles of the loam would be washed away together by the rains, thus preserving at the surface nearly the original proportions between the two.

In the following detailed descriptions of the agricultural regions of this southern part of the state these general principles will find many applications.

THE OAK AND PINE UPLANDS REGION.

This region, with its subdivisions, embraces an area of 16,915 square miles, and includes some of the best uplands of the state. Its two principal subdivisions, as already stated, are named from the species of pine which characterize them. As far north as about latitude 33° 30′ the long-leaf pine is prevalent; farther north it is the short-leaf species. The northern and eastern margins of this region (lying next to the preceding general divisions) are well characterized by the accumulation of flinty pebbles.

The soils along this gravelly belt are not materially different from those of the other parts of the oak and pine

uplands, except that they are, in general, rather poorer and more sandy; but since a line of gravelly hills, timbered with oaks and long-leaf pine, runs along the border of the metamorphic or crystalline rocks through South Carolina and Georgia into Alabama with substantially the same characters, this division is here retained.

OAK AND HICKORY UPLANDS, WITH SHORT-LEAF PINE.

This region includes the whole or parts of Lauderdale, Colbert, Marion, Lamar, Fayette, Tuscaloosa, and Pickens counties, with an area of about 4,135 square miles. In its soils and topography it is so closely connected with the next two regions that a special account of the same would involve much repetition. Along the eastern margin of this region there are some modifications of the soils, brought about by the influence of the underlying rocks, which in the three first-named counties belong to the sub-Carboniferous formation, and in the others to the Coal Measures. These, however, have not been specially studied, and the larger proportion of the soils may be referred to the red loam, which also in great measure makes the surface of the following regions. Most of the soil varieties occurring in the region next to be described have their representatives here, and the analyses there given will show their general characters in this section also.

GRAVELLY PINE HILLS, WITH LONG-LEAF PINE.

This subdivision occupies a belt of varying width, but averaging perhaps 30 miles, bordering on the south and west the older formations of the state (Metamorphic, Silurian, and Carboniferous), and hiding the line of contact between these and the Cretaceous formation. This belt stretches from Lauderdale county, on the northwest, to Russell county, on the east, and includes the following counties and parts of counties: The western parts of Lauderdale, Colbert, Franklin, Marion, Lamar, and Fayette; nearly all of Pickens, Tuscaloosa, and Bibb; northern Greene, Hale, Perry, and Dallas, southern Chilton, nearly all of Autauga, southern Elmore, and Tallapoosa; northern Montgomery, most of Macon and Russell, and southern Lee.

Within these limits there are about 6,170 square miles in which the drift beds conceal completely the underlying rocks and 2,650 square miles in which these surface beds make the greater part of the soils and the older rocks show only along the water-courses. The whole area in which the gravelly hills with short-leaf and long-leaf pines characterize the country may thus be placed at about 8,820 square miles. But since these gravelly hills with short-leaf pine timber in the northwestern part of the state present no very clearly marked points of difference from the short-leaf pine uplands of Mississippi, into which they gradually pass, it is only that portion of the gravelly hills with long-leaf pine that is to be considered under this head. With these limitations, therefore, this region embraces parts of the counties of Tuscaloosa, Pickens, Greene, Hale, Bibb, Perry, Dallas, Chilton, Autauga, Elmore, Montgomery, Tallapoosa, Macon, Lee, and Russell, with an area which has been estimated at 4,685 square miles.

GENERAL CHARACTERS.—As the name indicates, this subdivision has a rather uneven, hilly surface, especially where the table-lands break off toward the water-courses. Between these there are often tolerably wide tracts of nearly level land. The hills are, in general, clothed with a growth of upland oaks, among which the pines are usually conspicuous.

The surface over most of this territory is formed of beds of red or yellowish loam varying in thickness from a few inches to 25 feet. This loam is, in general, devoid of lines of stratification, and overlies beds of sand and pebbles, which are very distinctly stratified, although the stratification is extremely irregular. All these beds rest upon a worn or eroded surface of the older rocks, and on this account the thickness varies considerably. In many parts of the region the sands and pebbles have been cemented together into pretty solid rocks by the iron which is so generally present as coloring matter. These are the only hard rocks belonging to the surface beds. In some parts of the more northern counties, and in Tuscaloosa, these pebbly conglomerates act an important part in the production of topographical features, and in most of the region the hills, and even slight elevations, will be found to be capped with a sheet of ferruginous sandstone formed in this way, and giving rise to the elevation by protecting the strata from washing away. Wherever the red-colored sands and beds of pebbles rest upon a sheet of impervious clay the conditions for the formation of these rocks exist.

AGRICULTURAL FEATURES.—The red or yellow loam, above mentioned as overlying the stratified sands and pebbles of the drift, forms all the best upland soils of this region; but in places the underlying sands occupy the surface, forming very light soils, which may produce well for a while, but are soon exhausted. Between these two extremes there are many grades of soils resulting from their intermixtures. The loam, as above stated, with a variable thickness, overlies the stratified drift, and where the thickness is considerable, from 2 or 3 feet upward, the soils have the usual character of those of the brown-loam uplands. When fresh they will yield under good cultivation from 1,000 to 1,200 pounds of seed-cotton to the acre, but soon fall off in productiveness. Between the streams the country has the character of plateau or table-land, and is not much broken or hilly. The following analyses will show the general nature of the uplands and table-lands soils:

No. 6. *Upland sandy loam* (second class table-lands) from 4 miles east of Prattville, Autauga county, collected by Dr. S. P. Smith. The somewhat sandy top soil is underlaid to the depth of 20 feet by red clayey loam, below

which is a coarse yellow sand alternating with clay. Depth, 8 inches; vegetation, short-leaf pine, red and post oaks, hickory, dogwood, black gum, chestnut, persimmon, etc.; color, yellowish-brown on surface, passing into light-red below.

No. 57. *Brown-loam soil* from near Mulberry post-office, Autauga county, collected by T. D. Cory. Depth, 6 inches; vegetation, one-third pine, with white, post, and red oaks, hickory, dogwood, and black gum; color, light brown, changing below 6 inches to dark red. The fresh land will yield from 800 to 1,200 pounds of seed-cotton to the acre, but after several years' cultivation the yield is reduced to 200 or 400 pounds.

No. 60. *Subsoil of No.* 57. Depth, 6 to 12 inches; color, dark red.

Where the table-lands break off in the direction of the water-courses the top stratum of red loam becomes thinner, and in places is entirely removed, leaving the underlying sands at the surface. In the latter case the lands are scarcely worth cultivating, except in the creek bottoms, and even here the thin sandy soils with sandy subsoils are very soon exhausted. About a third of the tillable lands in the pine woods have a subsoil of greater or less thickness of this red loam, and though the soil is thin, it is moderately profitable to cultivate, because of the clay subsoil. The character of this variety of pine lands will be seen from the following analyses:

No. 3. *Upland pine-woods soils* near Prattville, Autauga county. Depth, 8 inches; vegetation, long-leaf pine, hickory, red, post, and black-jack oaks, dogwood, persimmon, etc.; color, ashy-gray at top, changing to yellowish in subsoil. The fresh land will yield 400 pounds of seed-cotton to the acre.

No. 4. *Subsoil of No.* 3, Autauga county. Depth, 12 to 18 inches; color, yellowish. Soil and subsoil collected by Dr. S. P. Smith.

Lands of the gravelly hills, Autauga county.

	SHORT-LEAF PINE LANDS—BROWN LOAM.			LONG-LEAF PINE LANDS—SANDY.	
	Upland sandy loam near Prattville.	Brown sandy loam near Mulberry.		Uplands pine woods.	
	Soil.	Soil.	Subsoil.	Soil.	Subsoil.
	No. 6.	No. 57.	No. 60.	No. 3.	No. 4.
Insoluble matter	89.100	91.510	84.520	94.170	88.860
Soluble silica	2.840 } 91.940	1.960 } 93.470	4.620 } 89.140	1.390 } 95.560	3.380 } 92.240
Potash	0.073	0.115	0.136	0.040	0.111
Soda	0.018	0.064	0.010	0.006	0.029
Lime	0.060	0.057	0.109	0.069	0.047
Magnesia	0.061	0.140	0.172	0.052	0.139
Brown oxide of manganese	0.122	0.027	0.171	0.117	0.125
Peroxide of iron	1.577	1.527	2.422	0.744	1.573
Alumina	4.350	0.943	6.078	0.603	4.320
Phosphoric acid	0.077	0.042	0.078	0.062	0.077
Sulphuric acid	0.034	0.018	0.074	0.009	0.002
Water and organic matter	2.206	2.888	2.477	2.807	1.660
Total	100.518	99.226	100.867	100.069	100.322
Hygroscopic moisture	3.882	2.905	5.89	1.916	6.079
absorbed at	16 C.°	28 C.°	29 C.°	24 C.°	19 C.°

The analyses of brown-loam soils show deficiencies in the principal elements of plant-food, potash and phosphoric acid, and also in lime, showing these to be essentially inferior soils. There is an important difference, however, between the soil and subsoil (Nos. 57 and 60) in their retentiveness of hygroscopic moisture, as shown by the determinations, and the subsoil is also somewhat richer in lime and in plant-food than the top soil. Deep plowing is, therefore, at once suggested as a means of improvement. Manures will be well retained both by subsoil No. 60 and by loam soil No. 6, which is intermediate in composition and physical properties between soil No. 57 and its subsoil. In the pine-woods lands the soil is seen to be lacking in all the elements of fertility, being composed mostly of sand, with very slight retentive power. Stimulant manures will do little good except for a very short time. For permanent improvement nutritive manures are necessary. The subsoil is superior in all respects to the top soil, and deep plowing will be attended with good results. The absorptive power of this subsoil is quite marked for so sandy a material, and this property, probably more than anything else, makes it possible to cultivate such soils with profit.

In some parts of this region there is a kind of pond lands, which, when drained, will produce very well for a year or two, but are then apparently completely exhausted. The accompanying analysis shows its chemical nature:

No. 61. *Pond-land soil* (exhausted) near Mulberry, Autauga county, collected by T. D. Cory. Depth, 12 inches; vegetation, mostly sweet gum; color, a dark gray.

Pond-land soil (exhausted) near Mulberry, Autauga county.

	No. 61.
Insoluble matter	78.630 } 84.675
Soluble silica	6.045 }
Potash	0.193
Soda	0.094
Lime	0.019
Magnesia	0.198
Brown oxide of manganese	0.079
Peroxide of iron	0.810
Alumina	7.951
Phosphoric acid	0.076
Sulphuric acid	0.132
Water and organic matter	6.101
Total	100.328
Hygroscopic moisture	7.697
absorbed at	27.8 C.°

In this soil it would appear that a deficiency in the lime is the chief cause of its rapid exhaustion, and liming is the first improvement indicated. It is lacking also in potash and phosphoric acid.

The bottom soils of this region vary with the surrounding uplands, and are, as a rule, easily cultivated and quite fertile, as they contain the best portions of the soils of the uplands. The second bottom or hummock soils are, in great measure, similar to the upland soils, but are usually somewhat stronger. The best farming lands in the region are to be found in the river hummocks or second terraces, and the general character of both will be seen from the following analyses:

No. 9. *Alabama river first-bottom soil*, 4 miles west of Montgomery, in Autauga county, collected by Dr. S. P. Smith. Depth, 8 inches; vegetation, red and white oaks, poplar, beech, hickory, sweet gum, elm, slippery elm, walnut, wild cherry, ash, sourwood, dogwood, grapes, and muscadines; color, light-brown top soil, with yellowish subsoil.

No. 20. *Warrior river hummock soil* (virgin), plantation of James R. Maxwell, near Tuscaloosa, collected by James R. Maxwell. Depth, 6 inches; vegetation, originally a dense cane thicket, with some sweet gum and red oak; color of the top soil, a light to dark brown, changing at the depth of 10 inches to a reddish-brown. The fresh land will produce 1,000 pounds of seed-cotton or from 50 to 60 bushels of corn to the acre.

No. 66. *Warrior river hummock soil* from the same locality as the preceding, but taken to the depth of 14 inches.

No. 21. *Warrior river hummock soil* (cultivated twenty years) from the same locality. Depth, 14 inches; vegetation, same as No. 20.

No. 22. *Warrior river hummock subsoil*, subsoil of Nos. 20, 21, and 66. Depth, 14 to 24 inches; color, reddish-brown.

Nos. 20, 66, 21, and 22 were collected by James R. Maxwell.

	AUTAUGA COUNTY.	TUSCALOOSA COUNTY.			
	Bottom lands, Alabama river.	Hummock lands, Warrior river.			
	First-bottom soil.	Virgin soil to depth of 6 inches.	Virgin soil to depth of 14 inches.	Soil after 20 years' cultivation to depth of 14 inches.	Subsoil of the three preceding; depth, 14 to 24 inches.
	No. 9.	No. 20.	No. 66.	No. 21.	No. 22.
Insoluble matter	77.080 } 83.117	73.995 } 80.513	69.900 } 80.887	73.339 } 82.116	71.227 } 81.892
Soluble silica	6.037 }	6.518 }	10.987 }	8.777 }	10.665 }
Potash	0.335	0.252	0.448	0.383	0.504
Soda	0.189	0.052	0.033	0.052	0.196
Lime	0.136	0.468	0.343	0.314	0.241
Magnesia	0.303	0.429	0.547	0.502	0.516
Brown oxide of manganese	0.384	0.006	0.190	0.041	0.081
Peroxide of iron	5.357	4.395	5.303	4.590	10.254
Alumina	4.841	5.182	6.004	5.288	2.195
Phosphoric acid	0.137	0.276	0.325	0.214	0.284
Sulphuric acid	0.040	0.071	0.072	0.072	0.034
Water and organic matter	5.230	8.893	6.311	6.617	4.490
Total	100.069	100.535	100.463	100.189	100.597
Humus	1.047	2.310	.....	.....	.....
Available inorganic	0.863	1.255	.....	.....	.....
Available phosphoric acid	0.058	0 112	.....	.....	.....
Hygroscopic moisture	8.193	18.811	8.707	15.836	14.016
absorbed at	17.2 C.°	17 C.°	29 C.°	20 C.°	17 C.°

By its composition the bottom soil is seen to be an excellent soil, and the large crops, especially of corn, which it produces are what might be expected from an inspection of the analysis. It is liable to overflow in many parts, and is therefore less planted in cotton than in grain.

The hummocks are also good soils, having, above the average content of phosphoric acid, a good supply of potash, and a sufficient quantity of lime to make these ingredients available. In comparing the analyses we find that the percentage of phosphoric acid and potash increases with the depth, while the lime decreases in quantity, it being greatest at the surface. They are all sufficiently retentive of moisture, and will hold manures well. The cultivated soil, No. 21, is very little inferior to the virgin soil in the elements of fertility, and the observed difference in the productiveness of the two is doubtless due to the circumstance that the fresh soil contains plant-food in a more easily available form.

It is a matter of experience that when the top soil has been washed off, as, for instance, on the low knolls, the reddish-brown subsoil appears to be, for a time at least, almost barren. This, as we see from the analysis, cannot be due to any deficiency in the elements of plant-food, and must, therefore, be owing to the physical and chemical conditions of the material, to its compactness, want of vegetable matter, and perhaps also of lime, to render available the plant-food which it actually contains. Thorough breaking up, plowing in of green crops, and applications of lime would undoubtedly in a very short time make this subsoil quite as productive as the soil.

The humus determination of the virgin soil, No. 20, shows 0.112 per cent. of available phosphoric acid, a very large proportion of the total amount present.

OAK AND HICKORY UPLANDS, WITH LONG-LEAF PINE.

The belt of country lying between the central prairie region on the north and that of the long-leaf pine region on the south is characterized by the almost universal presence of the long-leaf pine among the timber trees, but with it, in the upper part of the belt, are associated the upland oaks and hickories in perhaps equal proportions, but diminishing in frequency southward, and thus forming a transition into the long-leaf pine region proper. Under this head are embraced parts of the following counties: Sumter, Choctaw, Clarke, Marengo, Wilcox, Monroe, Conecuh, Butler, Crenshaw, Covington, Coffee, Pike, Montgomery, Bullock, Barbour, Dale, and Henry, and the area included is about 8,095 square miles.

While the upper and lower parts of this division in their extreme characters differ widely, they nevertheless shade off imperceptibly into each other, and it is not possible, except in a general way, to draw the line between them. In the upper half the prevailing soils are brown sandy loams, with a growth of upland oaks and hickories and some short-leaf and long-leaf pines; in the lower half the soils are more sandy, and the timber consists largely of long-leaf pine, along with black-jack oak and others which usually affect sandy soils. It will be most convenient to speak of this region under the two heads of brown-loam uplands and pine uplands, bearing constantly in mind the fact that these names merely serve to call to mind the predominant characters of the two sections, and that in each there are tracts of greater or less extent which have all the distinctive marks of the other.

1. BROWN-LOAM UPLANDS.—This section forms the upper or northern half of the region which we are describing, and embraces parts of the counties of Sumter, Choctaw, Clarke, Marengo, Wilcox, Monroe, Butler, Crenshaw, Montgomery, Pike, Bullock, Barbour, and Henry, with an area which is approximately 4,105 square miles.

In the lower part of Sumter and Marengo and the upper part of Choctaw, Clarke, and Wilcox counties the lignitic or Lower Tertiary strata, which underlie this division, consist of laminated clays and sands, to which are subordinated beds of lignite and of shell marls, often very rich in greensand or *glauconite*. Eastward, however, the lignitic character of the deposits to a certain extent disappears, the beds becoming more exclusively marine, and consisting of sandy materials, often highly fossiliferous.

In Barbour, Bullock, and Pike counties the northern limits of these uplands adjoin the blue marls and other beds of the Upper Cretaceous formation, from which they are separated west of Lowndes county by a belt of flatwoods. The underlying beds, however, both east and west, are in most cases at sufficient depths below the surface to exercise comparatively little influence upon either soils or topography.

Exceptions to this are seen in Wilcox, Marengo, and Choctaw counties, where the beds of greensand marl above mentioned are brought to the surface by denudation and give rise to lime-hills, which, in the character both of their soils and their rugged topography, resemble the lime-hills of the Jackson group farther south. A well characterized belt of such lime-hills may be traced from Lower Peach Tree, in Wilcox county, westward through northern Clarke and Choctaw to the Mississippi line. This belt runs parallel with, and a short distance north of, the rocky hills formed by the sandstones and other strata of the Buhr-stone group.

A soil of this lime-hills region was collected about 10 miles west of Lower Peach Tree, in Wilcox county, of which the analysis is given on page 42.

No. 140. *Lime-hills soil*, 10 miles west of Lower Peach Tree, Wilcox county. Depth 8 inches; color, yellowish-gray, with a slightly greenish tinge; vegetation, chiefly beech, but mixed with hickory, white oak, sweet gum, a few short-leaf pines and *Pinus glabra*, ash, some Spanish oak, poplar, pig-nut, sourwood, cucumber trees, holly, and sour gum.

Lime-hills soil, Wilcox county.

	No. 140.	
Insoluble matter	75.550	76.684
Soluble silica	1.134	
Potash		0.174
Lime		0.184
Magnesia		0.014
Brown oxide of manganese		0.082
Peroxide of iron		5.545
Alumina		7.772
Phosphoric acid		0.229
Sulphuric acid		0.060
Water and organic matter		8.922
Total		99.616
Hygroscopic moisture		17.067
absorbed at		10.5 C.°

In this soil the percentage of phosphoric acid, as also the hygroscopic moisture, is high; the lime and potash sufficient.

Another belt, characterized by the occasional appearance of calcareous soils, runs parallel to and some 15 or 20 miles north of the one just described, and is well displayed, for instance, near Luther's store, in Marengo county. Similarly in eastern Alabama the prevailing loam soils are, in places, greatly improved by admixture with the greensand marls occurring there. Otherwise, the superficial beds of loam, sand, and pebbles determine almost exclusively the agricultural and other characters of the region.

On account of the almost universal presence of a bed of red or yellowish-red loam overlying the sandier materials of the drift the topography of this region is quite varied because of the unequal degrees of resistance thus offered to denudation. The water-sheds are usually of the nature of table-lands, which break off toward the streams in somewhat rugged hills. The loam rests upon beds of sand and pebbles, as above stated, and hence an abundance of good freestone water in every part of this region, even in the driest seasons.

The agricultural characters of the upland region are determined almost exclusively by the nature of these superficial beds, and the distribution of the soil-varieties will be understood from the following considerations: The rocks of the country were covered with beds of sand, and in some places with beds of pebbles, which in turn were overlaid with a red or brownish-yellow loam of 20 or 30 feet thickness. The latter forms, in most cases, the soils and subsoils of this region, with the exceptions to be noted hereafter. Wherever the thickness of the loam is considerable, say 5 feet and upward, the water-sheds and territory generally formed by it are mostly of the nature of nearly level table-lands, whose general elevation above the main water-courses is 350 or 400 feet. On these table-lands the soil is usually a brown sandy loam, increasing in stiffness with the depth from the surface, and resting upon a subsoil of clay loam of a red or reddish color. The natural growth consists of numerous species of upland oaks, conspicuous among which are the Spanish, post, red, black, and black-jack, and hickories and short- and long-leaf pines.

Upon the table-lands there are varieties of soil depending upon the degree of sandiness, and the deterioration in quality is generally marked by the accession of the pines to the oak growth—short-leaf pine first, then the long-leaf pine. Below a certain depth, or within a certain distance of the top of the underlying drift-sands, the loam becomes more and more sandy, making a very gradual transition to the underlying beds. Along the edges of the table-lands, therefore, and in corresponding positions where the greater part of the loam has been removed, its sandy lower portions, and the sands of the drift itself, form the soils, which are then of inferior quality, as is shown by the growth, which consists of long-leaf pine and black-jack, or of the former alone. Of this character are the sandy pine ridges which are interspersed with the better table-lands. They have a poor sandy soil, which often produces pretty well for a short while, but is soon exhausted. Between the two extremes thus accounted for are numerous gradations resulting from their intermixtures.

It should not be inferred from what has been said that everywhere at elevations 20 or 30 feet below the general level of the table-lands the sands of the drift would be denuded of the loam and alone form the soils, for both the drift and the overlying loam seem to conform more or less to the more prominent topographical features of the country, as if they had been deposited over a surface which had already been eroded in conformity with present systems of drainage. It is otherwise difficult to account for the fact that we constantly find, sometimes 75 or 100 feet below the level of the table-lands, terraces of greater or lesser width having a capping of considerable thickness of the same red loam, underlaid by sand and pebbles, just as is the case on the table-lands themselves; and, even more, the second bottoms of the larger streams often present the same condition of things. At elevations intermediate between these successive plains are the pine ridges. It may be that a part of this is due to the subsequent degradation of the loam and its re-deposition along the slopes and over the lowlands; but this explanation

will not apply to all cases, for we should then always find the greatest thickness of loam at the lowest levels, and often find the relative positions of the loam and the sands and pebbles reversed, which is not the case.

The heaviest or stiffest loams are not, as a rule, found on the highest and broadest of the table-lands, but rather along their borders, where exposed to partial denudation, whence it would seem that upon the level table-lands, where the waters flow off slowly, there is a constant tendency toward increasing sandiness in the top soil, caused by the carrying down from the surface by percolating water of the finer clayey particles. Along slopes, however, the more rapidly flowing waters remove both the finer clay and coarser sand, and the proportion of these two ingredients originally existing in the loam is preserved.

It often happens that the freshly-exposed loam appears to be rather sterile, but this is due to the physical condition, and not to the inferior chemical composition, as may be seen from analyses made of soils from Tuscaloosa county, given under "the gravelly pine hills" division. As illustrating the composition of the sandy varieties of these upland loam soils, the following analyses are presented:

No. 94. *Sandy upland loam soil* from near Clayton, Barbour county, collected by Judge H. D. Clayton. Depth, 12 inches; vegetation, Spanish and other oaks and hickory; color, light yellowish-gray, with a subsoil a shade more yellow. This soil is extensively cultivated and much prized, but it almost invariably rusts cotton.

No. 84. *Upland loam soil* from near Lawrenceville, Henry county. Depth, 10 inches; vegetation, Spanish and post oaks, with a few black-jacks, hickory, chestnut, sour gum, short-leaf pine, and a few long-leaf pines; long moss on some of the trees; color, light yellowish-gray top soil, deeper yellow below, all resting upon a red clay loam at 2 to 3 feet depth.

The composition of the better class of brown-loam soils is illustrated by the following analyses:

No. 18. *Upland brown-loam soil* from 5 miles southeast of Troy, Pike county. Depth, 8 inches; vegetation, red oaks and a few short-leaf pines; color, dark-brown.

No. 19. Subsoil of No. 18. Color, reddish-brown.

Upland brown-loam soils (oak and hickory uplands, with long-leaf pine).

	SANDY LOAM.		BROWN LOAM.	
	Barbour county.	Henry county.	Pike county.	
	Soil.	Soil.	Soil.	Subsoil.
	No. 94.	No. 84.	No. 18.	No. 19.
Insoluble matter	95.091	95.115	91.965	90.960
Soluble silica	1.913 } 97.004	1.155 } 96.270	1.915 } 93.880	2.425 } 93.385
Potash	(*	0.212	0.077	0.150
Soda	0.007	0.096	0.013	0.056
Lime	0.010	0.058	0.112	0.048
Magnesia	0.056	0.039	0.094	0.080
Brown oxide of manganese	0.131	0.128	0.044	0.092
Peroxide of iron	0.603	0.803	1.431	1.574
Alumina	1.386	0.703	1.841	3.197
Phosphoric acid	0.025	0.100	0.109	0.072
Sulphuric acid	0.001	0.016	0.015	0.072
Water and organic matter	0.443	2.009	2.137	1.532
Total	99.666	100.434	99.753	100.258
Hygroscopic moisture	0.878	1.225	2.590	2.826
absorbed at	5.6 C.°	23.3 C.°	19.4 C.°	18.3 C.°

* Undetermined.

The analyses given on page 49 of upland sandy-loam soil and subsoil from 2½ miles south of Union Springs, Bullock county, may also be consulted, since they are of essentially the same character, being derived from the loam, but which, on account of their relation to the Chunnenugga ridge, have been presented in connection with it.

A comparison of the four analyses above given with those of the gravelly pine hills north of the prairie region will show that they are essentially similar soils, as was to have been inferred from the identity of the material from which both classes have been derived. They are all below the average quality, and are more or less deficient in potash, phosphoric acid, and lime. Enough plant-food in them appears, however, to be in an available form to render them all quite productive for a time. No. 18 is remarkably deficient in potash and No. 94 in lime. No. 94 is also greatly deficient in organic matter and in retentiveness for moisture, but the latter defect is partly remedied by the subsoil, which is a rather stiff loam.

Passing mention has been made of the modifications brought about by the greensand and other marls which form a part of the underlying strata of this division. The more important soil-varieties thus produced are described

hereafter. The reaction of the greensand deposit upon the loam often produces a soil remarkable for its deep-red color and for its fertility. These soils occur in detached bodies in the brown-loam uplands, and have been observed more frequently in the eastern part of the region, though occurring probably in all parts of it. Near Clayton, in Barbour county, and Greenville, in Butler, are characteristic occurrences. The top soil is usually reddish-brown, and the deep-red color is better seen in the subsoil. The vegetation consists of Spanish, white, red, black, and post oaks, hickory, short-leaf pine, sweet gum, sour gum, dogwood, persimmon, chestnut, and chincapin. When fresh, such soils will produce 1,000 pounds of seed-cotton or 20 bushels of corn to the acre. A partial analysis of a red soil from near Greenville shows some 97 per cent. of insoluble matter in the top soil, which is quite high for so good a soil, but the loamy character of the subsoil remedies this defect.

In the western counties of this region the lignitic clays and sands are interstratified with several beds of greensand marl, and where these come to the surface prairie spots and a kind of lime-hills are produced, which are perhaps best seen in Wilcox, Marengo, northern Clarke, and Choctaw counties. One of these marl-beds exposed in the river bank at Nanafalia landing is composed chiefly of the shells of a small species of Gryphea (*G. Thirsæ*). This bed comes to the surface in many places near Luther's store, in Marengo county, and probably also in parts of Choctaw county, producing very characteristic prairie spots.

Another marl-bed which is seen on the Tombigbee river at Wood's bluff and on the Alabama river above Lower Peach Tree gives rise to a belt of lime-hills extending from the Alabama river, through Wilcox, Clarke, and Choctaw counties, to the Mississippi. The best display of these hills is probably seen between Choctaw Corner and Lower Peach Tree. The marl-bed containing greensand is there at least 100 feet above the general drainage, and has, both above and below it, laminated gray clays, in the lower part of which occur one or two thin seams of lignite. The country is very much broken, and in this respect bears a striking resemblance to the lime-hills region of southern Clarke, etc.

The drift-beds have been generally removed, and the soils mostly come directly from the disintegrated clays and the associated marls. The most characteristic soil is a heavy clayey loam of a yellowish-gray color with a slightly greenish tinge. Where the drift loam is present the color is more decidedly red and the soil more sandy; and where this loam is absent, and the marl is least felt, the crumbling clays yield a heavy, dark-colored argillaceous soil. The vegetation is chiefly beech, which grows both on hills and in the bottoms. With it are associated hickory, pig-nut, white and Spanish oaks, sweet gum, ash, poplar, sourwood, holly, sour gum, cucumber trees, numerous spruce or swamp pines (*P. glabra*), and a few short-leaf pines. These hills are very generally cleared and in cultivation, which is proof of their fertility. Their usually steep slopes are, however, soon denuded of soil, and where turned out they are rapidly cut up by deep and unsightly washes.

Westward from Wilcox county, so far as my observation goes, these lime-hill areas are more sparingly interspersed among the other classes of soils which are derived from the drift. The lime-hills of northern Monroe are no doubt also partly of this character. No analyses have yet been made of the calcareous soils of this particular section.

The second bottoms of this section, especially those of the larger streams, are among the best farming lands of the state. The analyses of the second-bottom soils from Autauga and Tuscaloosa counties are illustrations in point, although they have been presented under the division of the gravelly pine hills. The following analysis of a hummock soil from the Alabama river is presented as an additional illustration of the character of the second-bottom soils of the brown-loam region:

No. 92. *Second-bottom soil* of the Alabama river, in Black's bend, 5 miles east of Lower Peach Tree, Wilcox county. Depth, 9 inches; vegetation, sweet gum, short-leaf pine, Spanish, red, and white oaks, poplar, haw, and hackberry; color, brown, speckled with red.

Second-bottom soil of Alabama river, Wilcox county.

	No. 92.	
Insoluble matter	86.510	89.779
Soluble silica	3.269	
Potash		0.168
Soda		0.074
Lime		0.221
Magnesia		0.055
Brown oxide of manganese		0.184
Peroxide of iron		1.788
Alumina		2.290
Phosphoric acid		0.200
Sulphuric acid		0.073
Water and organic matter		4.510
Total		99.337
Hygroscopic moisture		5.916
absorbed at		22.2 C.°

A comparison of this analysis with those of the second-bottom soils of the Alabama and Warrior rivers, previously alluded to, will show that this, while somewhat more sandy, is still a good soil. The proportion of phosphoric acid is large; that of potash adequate; and the large percentage of lime renders the soil thrifty by putting in an available form all the nutritive ingredients.

2. PINE UPLANDS.—We have seen that the lower or southern half of the oak and long-leaf pine uplands is characterized by the predominance of the long-leaf pine among its timber and by the usually broken and hilly nature of its surface. This section embraces parts of Choctaw, Washington, Clarke, Monroe, Conecuh, Butler, Covington, Crenshaw, Pike, Coffee, Barbour, Dale, and Henry counties, and has an area of about 3,990 square miles.

The surface characters of the eastern and western parts of this section are quite different. In the counties of Choctaw, Clarke, Monroe, northern Conecuh, and southern Butler the siliceous rocks of the Lower Tertiary or Buhr-stone formation lie near the surface and give rise to high and rugged rocky hills. In the other counties above named these rocks are more or less deeply covered with the more recent beds of sand and pebbles, and the surface is correspondingly much less broken. In this part of the section the surface is generally undulating, but sometimes it is hilly, particularly in the vicinity of the water-courses. In such positions, and sometimes along the ridges, the siliceous rocks above spoken of appear at the surface, but they fail generally to have much influence upon the topography.

The drainage area of the Chattahoochee river in Alabama seems to be characterized by a prevalence of sand among the surface materials, and quite extensive areas covered with deep sand-beds are not uncommon, as, for instance, in Dale county, around Ozark, and between that town and Newton. Throughout the entire pine-uplands section, within 25 or 30 miles of the principal streams, pebbles commonly underlie the surface loams, and the size of the pebbles and the thickness of the beds seem to increase with the approach to the stream. Along some of the rivers, as the Chattahoochee, the pebble beds may be followed nearly to the Gulf.

As the name indicates, the long-leaf pine is the prevailing tree over this whole section. Upon some of the poorer ridges this forms almost the only timber, but with it are usually associated black-jacks and high-ground willow oaks, the latter especially where the soil is most sandy. From this, the prevailing timber growth, it may be inferred that the soil is generally a rather poor sandy loam, with subsoil of a similar nature.

Along the northern edge of this belt many of the dividing ridges are of the nature of table-lands, supporting a mixed growth of the long-leaf pine, with post, red, black, and Spanish oaks, in addition to the black-jack. The same mixed growth is frequently seen also where the divides break off toward the water-courses, and in both cases the sandy soil is underlaid at moderate depths by a red clayey loam. Thus the line between the oak uplands and the pine hills is a shadowy one, and each of these divisions sends into the territory of the other spurs often of considerable length. Along the southern edge there is a similar blending of the characters of the pine hills with those of the lime-hills and the undulating pine lands.

Between these two divisions of the pine lands there is much less difference in the soils and natural productions than in the surface topography. The typical sandy loam, both of this and the undulating pine lands, is shown in the analysis of the soil from near Andalusia, in Covington county. On the other hand, the better class of upland soils in this division approach in composition the oak upland soils of the preceding division, and are sufficiently well represented in the analysis of the soil from near Lawrenceville, in Henry county (brown-loam uplands).

In the division of the lime-hills there are tracts which have all the characters of the pine hills, lying usually upon the higher ridges, as has been fully set forth under that head.

North of the prairie belt the gravelly pine hills have great resemblance to this division both in soils and topography, and the composition of the numerous soil-varieties occurring here can be seen by referring to the analyses given under that division. No analyses have as yet been made of any of the soils of this particular division, but the references given will illustrate the composition of all its principal soil-varieties.

The soils of the first and second bottoms are light and sandy, but quite productive, and form the greater part of the cultivated lands in this division, since the uplands are in general too poor for profitable cultivation. Where the red-loam subsoil is near the surface, and the various species of upland oaks are associated with the long-leaf pine, there is, as before stated, a great improvement in the soil, and the land is generally under cultivation; but these areas approach in character the oak uplands, and are, as a body, found in the upper part of this section and on the divides.

UPPER OR CENTRAL PRAIRIE REGION.

This forms a belt running somewhat diagonally across the state, having a width of some thirty miles near the Mississippi line, but narrowing down toward the east, and almost disappearing in Russell county, on the eastern border of the state. The prairie region includes parts of the following counties: Pickens, Sumter, Greene, Hale, Marengo, Perry, Dallas, Autauga, Lowndes, Butler, Montgomery, Crenshaw, Bullock, Macon, Russell, and Barbour, and embraces an area which is approximately 5,915 square miles.

GENERAL DESCRIPTION AND SUBDIVISIONS.—While under this name are included all those parts of central Alabama where the prairies occur, only a part, and not the largest part, of the area is of the genuine prairie character. As here used, the term "prairie" does not always mean a timberless region, but refers rather to the character of the soil, the most important varieties of which are described further on.

The Cretaceous formation upon which this region is based is in Alabama made up of three parts. The Eutaw group consists of clays and sands, which are for the most part so deeply covered with beds of stratified drift as to have little or no influence upon the soils or topography. Overlying this group is a great thickness of an impure argillaceous limestone interstratified with clays, called the rotten limestone. The disintegration of these beds gives rise to the true prairie soils. The uniformity in the composition of the rotten limestone has its influence on the topography of the region, which is a low trough, with gently undulating surface, bounded north and south by hills which rise two or three hundred feet above the general prairie level. The monotony of the plain is relieved by the occurrence, here and there, of ridges and conical hills capped with the pebbles and sand-beds of the drift, which at one time overspread the entire region. The irregularities of surface produced by the wearing away of the rotten limestone itself are comparatively insignificant. In much of this region the rocks lie very near the surface, and large trees are wanting entirely; but, on the other hand, there are many fine groves of oaks, walnut, poplar, etc.

In all the prairie country the surface water is strongly impregnated with lime, and is often insufficient in quantity. For a supply of this necessity recourse is usually had to artesian wells and cisterns, and, for farm purposes, to shallow ponds. Cisterns are dug into the limestone rock, and usually no brick-work is necessary. Wherever the drift and loam overlie the rotten limestone upon the ridges an adequate supply of pure freestone water is always to be had, and these sandy ridges are usually chosen as the sites for dwelling-houses, and often for towns and villages. From the uniformity of level the waters falling upon this region are very slowly drained away, and much of it soaks into the ground, converting it into a mud, which, when worked up by vehicles, soon renders the roads nearly impassable.

Next above the rotten limestone lie the beds of the Ripley group, consisting of hard, sandy limestone, sometimes crystalline, underlaid by strata of bluish micaceous marls. In contrast to the preceding division, the topography of the Ripley group is varied, the surface being more or less hilly, and while the beds of the stratified drift nearly always overlie the strata of this group, the country rocks come to the surface in many localities, giving rise to very marked agricultural features. The depressions are mostly filled with the materials of the drift, mingled more or less with the calcareous matter of the formation, but the limestone makes its appearance at the surface in numerous bald prairie spots, which are usually upon the tops or sides of the hills. The alternations of hard and softer strata make the hills usually rough and precipitous, and in some localities, as in Little Texas, in Lowndes county, the broken character of the country is extreme.

A belt of this hill prairie country usually borders the black prairie region on the south for most of the way across the state, at least from Marengo county eastward. In some places the bald prairie hill-tops are a conspicuous feature, as in Lowndes and Montgomery counties, but more commonly the limestone upon the ridges is covered with the drift, and then the country has the usual characters of the oak and pine uplands. Of such nature is the Chunnenugga ridge, which has its counterpart in the Pontotoc ridge of northeastern Mississippi. These occurrences will be more particularly described under the several counties.

In the eastern part of the state the bluish micaceous marls are exposed (by removal of the superficial drift) along the drainage slopes of certain streams which flow into the Chattahoochee river, and there is then produced a third class of lands, which characterize the low grounds of the Cowikee and Bear creeks, in Barbour and Russell counties. In this section of the state these blue-marl lands become as characteristic as the black prairie lands of the west, as was long since remarked by Professor Tuomey. In topography, the blue-marl lands are much like the oak and pine uplands, and the surface soil also is in a great degree composed of the same materials. To bring into prominence these three well-marked agricultural regions I have proposed the following division of the central prairie region:

The black prairie or canebrake region.
The hill prairies (Chunnenugga ridge, etc.).
The blue-marl lands.
The special agricultural characters of each of these divisions will be given under their several heads.

THE BLACK BELT OR CANEBRAKE REGION.

This division of the prairie region is underlaid by the rotten limestone before described, and in its topography and soils shows considerable uniformity. From the great thickness of the rotten limestone this division is much more widely spread than either of the others, occupying about 4,365 square miles. It is found in all the counties above included in the prairie region, except those on the extreme eastern border of the state—Barbour and Russell—where it is replaced by the blue-marl lands. The general character of the topography has already been given.

Throughout the canebrake or black belt the coating of drift which so generally overlies all the country rocks of the southern division has been more or less completely removed by denudation, but patches of it are left in places, chiefly upon the ridges and along the slopes, and these play an important part in the production of soil varieties.

(1.) Where the rotten limestone lies at the surface unmixed with the drift, it yields, on disintegration, a gray or greenish-gray clayey, calcareous soil, which becomes black or very dark-colored when mixed with vegetable

matter. The subsoil of the cultivated lands is usually of a lighter color than the top soil, and passes gradually into the lime rock at varying depths. A distinction is often made between the uppermost parts of this rock where it has been exposed to weathering, as it then resembles a whitish or chalky clay, quite different from the unchanged rock, which is frequently spoken of as the blue-marl rock. Where the depth of soil is sufficiently great it supports a varied growth of trees, among which the several species of oaks, ash, gums, walnut, and poplar are prominent.

From the slight elevations the soil has sometimes been washed away, and bald spots are left, where the bare rock often partly forms the surface (bald prairies). Such places are not suitable for cotton, but produce corn and oats very well. The yield of seed-cotton of the fresh black land is variously estimated between 800 and 1,800 pounds, the average of the estimates being about 1,200 pounds. Perhaps not more than one-fourth of the cultivated lands of this particular division have this kind of soil, which has, however, on account of its great and lasting fertility, given character to the entire region. The following analyses of black prairie soils, selected from the different parts of the state, will best show their character:

No. 30. *Black prairie soil* from 8 miles northeast of Livingston, Sumter county (on Jones' Bluff road), collected by Dr. R. D. Webb. Depth, 10 inches; vegetation, a few post, red and black-jack oaks, cedar and prairie white oaks; color, black or very dark gray.

No. 32. *Black prairie soil* from the edge of an open prairie 2 miles north of Livingston, Sumter county, collected by Dr. R. D. Webb. Depth, 10 inches; vegetation, post, red, black-jack, and prairie white oaks, cedar, walnut, and cane; color, black.

No. 16. *Black prairie soil* from W. M. Stakeley's, 4 miles east of Union Springs, Bullock county. Depth, 12 inches; vegetation, post and red oaks and short-leaf pine, haw, and crab-apple; color, black, with yellowish stiff clay subsoil resting on the rotten limestone; color of subsoil, black, passing below 6 inches into yellowish, waxy clay. In the sloughs and drains of the prairies the cream of the soil collects from time to time, and there is formed a soil of great thickness and strength. The subjoined analysis will show the character of such deposits.

No. 77. *Black prairie slough soil*, 8 miles south of Montgomery, Montgomery county. Depth, 8 inches; vegetation, chiefly white oak and hickory; color, black.

Black prairie soils.

	SUMTER COUNTY.		BULLOCK COUNTY.	MONTGOMERY COUNTY.
	8 miles northeast of Livingston.	2 miles north of Livingston.	4 miles east of Union Springs.	Prairie slough.
	Soil.	Soil.	Soil.	Soil.
	No. 30.	No. 32.	No. 16.	No. 77.
Insoluble matter	46.990	81.745	57.831	25.188
Soluble silica	17.920 } 64.910	2.346 } 84.091	10.431 } 68.262	23.792 } 48.980
Potash	0.444	0.205	0.288	0.441
Soda	0.077	0.076	0.027	0.119
Lime	1.961	0.960	0.961	8.678
Magnesia	0.603	0.061	0.802	1.170
Brown oxide of manganese	0.108	0.192	0.452	0.173
Peroxide of iron	6.944	3.843	7.855	7.074
Alumina	12.418	6.168	11.488	15.565
Phosphoric acid	0.102	0.318	0.507	0.201
Sulphuric acid	0.072	0.152	0.080	0.125
Carbonic acid				5.728
Water and organic matter	11.720	4.075	8.036	11.589
Total	99.359	100.141	98.728	99.843
Humus	2.830	2.000		2.460
Available inorganic	0.740	1.430		1.874
Available phosphoric acid	0.060	0.108		0.037
Hygroscopic moisture	1.283	6.042	14.489	19.992
absorbed at	22.3 C.°	27 C.°	17 C.°	7 C.°

All the above are good soils in every particular. The potash and phosphoric acid is adequate in all, and very high in Nos. 16 and 32, as is also the lime. No. 32 is deficient in organic matter, being taken from the edge of an open prairie, and it has also less capacity for moisture.

(2.) While the drift and loam have, as a rule, been removed from the rotten limestone, there are many places where they still remain, and where they have protected the underlying rocks from degradation, thus producing the sandy ridges and brown loam table-lands which often so agreeably relieve the monotony of the prairie region. These superficial beds give rise to a variety of soils, which upon many of the ridges do not differ from the loam soils of other localities, since they are formed of the same materials.

Where the loam is mingled with the prairie soils, as is the case along the slopes of the sandy ridges before mentioned, and where they occupy the slight depressions in the limestone, yellow or mulatto soils are formed, upon which the post oak is the most characteristic tree, for which reason they are often called post-oak prairies. With this tree are also associated the short-leaf pine and some black-jack and other oaks and hickories. All these trees are usually draped with long moss.

The post-oak prairie soils are mostly rather stiff calcareous loams of yellowish to reddish colors, having a subsoil of red or yellow-clay loam, which sometimes becomes more sandy with increasing depth, but which often retains much the same character down to the unchanged limestone rock (10 to 20 feet). On account of their position these lands are usually well-drained, and with good seasons are of easy tillage. As cotton lands they are perhaps quite as desirable as the black lands above described. The subjoined analysis will show the composition of an average soil of this kind.

No. 17. *Post-oak prairie soil* from Major Wright's, 3 miles from Union Springs, Bullock county. Depth, 12 inches; vegetation, post oak, draped with long moss, short-leaf pine, hickory, black-jack and some red oaks; color, 4 to 5 inches dark gray, then a sticky red clay, and below that a yellowish clay with "lime balls".

Post-oak prairie soil, Bullock county.

	No. 17.	
Insoluble matter	71.866	83.847
Soluble silica	11.981	
Potash		0.209
Soda		0.616
Lime		0.371
Magnesia		0.290
Brown oxide of manganese		0.055
Peroxide of iron		6.963
Alumina		6.022
Phosphoric acid		0.251
Sulphuric acid		0.073
Water and organic matter		2.888
Total		100.505
Humus		0.718
Available inorganic		2.426
Available phosphoric acid		0.015
Hygroscopic moisture		8.574
absorbed at		16.6 C.°

From what has been said, it may easily be inferred that there are all grades of soils, from the brown loams of the hills to the pure black prairie soils, and that the post-oak soils represent a medium between the two.

A comparison of the post-oak prairie soil with those of the black prairies shows that the former, as a rule, has a larger percentage of siliceous matter and less of lime and magnesia; differences which might have been anticipated in considering the modes of formation of the two classes. The analysis above shows a want of vegetable matter and a lower capacity for moisture as compared with the black soils; in other respects it is a fine soil. No. 32 (page 47), however, approaches in composition the post-oak soil except as regards lime.

(3.) The bottom soils of this region vary between very wide limits from the stiff black prairie slough lands, like No. 77 (page 47), which result from the concentration of the black prairie soil to light and rather sandy loams, and have usually enough lime to make them very strong and lasting.

HILL PRAIRIES AND CHUNNENUGGA RIDGE.

A belt of varying width of lands of this character is usually found bordering the prairie region on the south, and, as the hill prairies grade on the one hand toward the black prairies and on the other into the brown-loam uplands, it is somewhat difficult to estimate their extent, or, indeed, often to decide what shall be included in this division; but, restricting ourselves to the hilly region within which occur lands with very calcareous soils, its area may be given at about 1,000 square miles.

The hard sandy and crystalline limestones to which the hills owe their existence have already been mentioned. These alternate with beds of shaly clays of a yellowish and gray color, and this disposition of the strata gives rise to the characteristic topography of the limy prairie hills. The softer clays are easily washed away, and the limestone breaks off with perpendicular faces. The surface beds on the higher levels are the sands and loam of the drift, and, where the ridges are broad, they exhibit the usual characters of the brown-loam uplands, being timbered with the trees which grow in such localities, such as Spanish, white, post, and red oaks, hickory, short-leaf pine, sweet and sour gums, chestnut, dogwood, persimmon, etc. The broad ridges of this kind are usually water-

sheds or divides for long distances. The creeks flowing northward into the Tallapoosa and Alabama rivers, and southward into the Pea, Conecuh, Patsaliga, and Sepulga, are divided by the Chunnenugga ridge and its prolongation westward to Lowndes and Butler counties. The thickness of the drift and loam stratum varies with the locality, and in many places it is not more than 25 feet. These ridges and plateaus break off toward the black prairies in a series of rugged hills, along the slopes of which the limy clays are encountered soon after the summits are left. These hills are abrupt knolls, with a surface of a yellowish tenacious clay filled with white concretions of lime.

The timber consists of red, post, and Spanish oaks, short-leaf pine, sweet and sour gum, poplar, white oak, hickory, and ash, and all the trees are usually draped with long moss. In many places the hillsides are bare of vegetation and deeply gashed with gullies, and the surface in such bare spots is often strewn with fossil shells. At a certain stage of drying these clays acquire an extraordinary degree of tenacity, and so clog the wheels of vehicles as to render travel almost impossible. Wherever the sands and loams form the surface the roads are usually very good.

The soils of this region, considered from the point of view of their origin, are of three types: 1. Those derived from the surface beds of drift and loam. 2. Those based upon the calcareous rocks of the country. 3. Those resulting from the intermixtures of the two preceding.

The soils of the first kind exhibit the usual variations, depending upon the quality of the beds. The surface is commonly formed of a loam of several feet in thickness, resting upon sandier beds, occasionally mixed with pebbles. The broader parts of the ridges have often considerable tracts of level table-lands with the usual characteristic oak upland growth, and this passes into the other extreme of the pine hills, with long leaf pine and black-jack, with increasing sandiness of the soil. Between these two are many intermediate grades. Taking all things into consideration, the brown and yellowish soils are perhaps the most desirable of this class, and in their chemical composition they do not differ materially from the similar soils of the loam in other localities.

A well-defined ridge, which acts as a divide between waters flowing north and south, may be followed without interruption from Wilcox county along the line between Butler and Lowndes, through northern Crenshaw, southern Montgomery, and northern Pike, into Bullock. This ridge has its northern face overlooking the black prairies, usually rather steep and abrupt, while southward it slopes away very gradually, merging imperceptibly into the long-leaf pine and oak uplands. In Bullock county this is known as the Chunnenugga ridge. Its general surface is quite sandy, and a fair estimate of the sandy varieties of the ridge soils may be obtained from the following analyses:

No. 11. *Chunnenugga ridge soil*, 1 mile south of Union Springs, Bullock county. Depth, 6 inches; vegetation, chestnut, short-leaf pine, red oak, and sour gum; color of the top soil, dark gray, changing at 6 inches to a lighter gray, and at 3 feet to a yellowish color.

No. 12. *Chunnenugga ridge subsoil*, same locality as preceding. Depth, 6 to 26 inches; color, light gray.

No. 13. *Upland sandy-loam soil*, 2½ miles south of Union Springs, Bullock county. Depth, 6 inches; vegetation, Spanish and a few post oaks, short-leaf pine, and huckleberry bushes; color of top soil, gray, with a subsoil of light yellowish-gray color, resting on a reddish-yellow loam.

Sandy soils of Chunnenugga ridge, Bullock county.

	NEAR UNION SPRINGS.		SOUTH OF UNION SPRINGS.
	Soil.	Subsoil.	Soil.
	No. 11.	No. 12.	No. 13.
Insoluble matter	94.770	96.810	93.890
Soluble silica	0.486	1.060	1.878
	95.256	97.870	95.768
Potash	0.156	0.165	0.209
Soda	0.069	0.107	0.134
Lime	0.081	0.110	0.076
Magnesia	0.069	0.035	0.021
Brown oxide of manganese	0.156	0.065	0.065
Peroxide of iron	0.706	0.490	0.883
Alumina	0.733	0.867	1.260
Phosphoric acid	0.101	0.113	0.058
Sulphuric acid	0.057	0.035	0.063
Water and organic matter	2.642	0.550	2.062
Total	100.026	100.407	100.619
Hygroscopic moisture	1.943	0.822	1.842
absorbed at	18 C.°	17 C.°	19 C.°

From the preceding analyses it will be seen that soil No. 11 does not change very materially from the surface to a depth of 26 inches. For so large a proportion of siliceous and insoluble matter they all show a fair percentage of potash and phosphates, and of lime also, especially the subsoil No. 12. In vegetable matter and capacity for moisture the two soils stand very well. A comparison of these with some sandy upland soils of a preceding region will show great similarity, as might have been inferred from the identity in their origin. All these soils give probably fair returns for a short time, but they cannot hold out well.

Of the second class above mentioned, in which the soils are derived immediately from the country rocks, there are two principal varieties:

(1.) The bald prairie hills, in which the calcareous strata approach very near the surface and the soil proper is of slight depth. This soil resembles the bald prairies of the preceding division to some extent, but the country is more broken, and the hillsides are often badly washed.

(2.) The beeswax hummocks or beeswax flatwoods, the soil of which is a greenish-yellow, clayey material, timbered with black-jack oaks or with pines, forming the post-oak beeswax prairies and the beeswax pine lands of some sections (hog-wallow uplands of Mississippi). The stiff and unmanageable character of this kind of soil stands in the way of its successful cultivation.

The third class of soils, resulting from the intermixtures of the two classes just mentioned, exhibit all the grades between the brown loams of the uplands and the stiff beeswax soils above described. Upon these mixed soils the post oak is a characteristic growth, and the post-oak lands of this division are, in general, like those of the rotten limestone, which are formed in a similar way.

The surface loam is here, as elsewhere, more or less deeply tinged with iron, and in some places the color becomes a dark-red, and both soil and subsoil are filled with concretionary pebbles of brown iron ore. These are known in Alabama as the red gravelly lands, and are similar to the "Buncombes" of Pontotoc ridge, in Mississippi. In both states they are distinctly connected with calcareous strata. While these soils are fertile, they are not so desirable as other varieties, since the pebbles dull the plow and the lands are very liable to injury from washing. As yet no analyses have been made of any of these mixed soils, or of the bald hill-top prairies or beeswax lands, so that we can speak only in generalities concerning them.

BLUE-MARL LANDS.

These lands, which are underlaid by a bluish micaceous marl, are for the most part covered with beds of sand, loam, and pebbles of a later age, and it is only along the drainage slopes of certain streams flowing into the Chattahoochee river that the marls are concerned in the formation of the soils. The area over which their influence is felt in the soil is a limited one, and even within this area there are many varieties. It is thus somewhat difficult to fix upon an estimate of the area here included, but it is put provisionally at 550 square miles.

As already stated, the greater part of the territory of the blue marl is covered with later deposits, and bears, therefore, the characters of the brown-loam uplands and of the pine hills, according to the nature of the surface beds. Along the Cowikee and Bear creeks and their tributaries, however, these surface beds have in great measure been removed, and the blue marl and the stratum of joint clay, with which it is interbedded, are exposed. These materials, mixed with the loam from the higher levels, together form the well-known Cowikee lands. Throughout the region the comparatively level clayey or marly lands alternate with ridges capped with a highly micaceous sandy loam. The ridges, as before stated, are sandy, and are timbered with post and black-jack oaks and long-leaf pine; but where the soil becomes more loamy the pines diminish in numbers, and the other species of oaks replace partly or entirely the black-jack.

On each side of the Cowikee and Bear creeks the lands are stiffer, from an admixture of the clay above mentioned, and more productive, because of the presence of lime. On these creeks there are level or gently undulating tracts with a clayey soil, forming a kind of prairie, in which, strange to see, the long-leaf pine is a prominent tree, associated with hickory, white and Spanish oaks, and, in the lower places, with sweet and sour gums and maple, all covered with long moss. In many places the stiff clay subsoil is filled with white concretions of lime, derived probably from the marl. In some of these localities the short-leaf pine replaces the long-leaf species. It is thought by some that the lands on the north side of the creeks are lighter and less charged with lime than those on the south side, and there is a corresponding difference in the growth of the cotton, which on the north side is smaller and more liable to rust after a few years' cultivation of the soil. In the so-called Cowikee lands of this region there are patches of hog-wallow clay, a stiff intractable substance.

The lowlands in this region are inhabited mostly by the blacks, by whom they are cultivated, since the white people suffer from malarial fevers. One analysis has been made of the soils of this region.

No. 96. *Bottom or low-grounds soil*, Cowikee lands, north of Clayton, Barbour county. Depth, 8 inches; vegetation, red, white, and post oaks, hickory, and short-leaf pine; color, brown, changing into light yellowish-gray subsoil.

Low-grounds soil, Cowikee lands, Barbour county.

	No. 96.	
Insoluble matter	73.303	84.895
Soluble silica	11.592	
Potash		0.245
Soda		0.060
Lime		0.280
Magnesia		0.351
Brown oxide of manganese		0.113
Peroxide of iron		2.666
Alumina		5.489
Phosphoric acid		0.113
Sulphuric acid		0.013
Water and organic matter		4.708
Total		98.983
Hygroscopic moisture		5.544
absorbed at		5.6 C.°

As has been said, the Cowikee lands are considered the best cotton lands in the section in which they occur. The analysis shows a fair proportion of potash and phosphoric acid, with a large percentage of lime, by which these are put in an available condition. From the large amount of siliceous matter this soil is easily tilled. The statistical map shows that about 20 per cent. of the whole area formed by these soils is cultivated in cotton.

POST-OAK FLATWOODS REGION.

This region occupies a narrow belt extending from the Mississippi line through the lower part of Sumter and the middle of Marengo to the Alabama river, in the vicinity of Clifton, in Wilcox county, and embraces an area which is approximately 335 square miles.

The flatwoods or post oaks have an average width of perhaps 3 to 5 miles, and a nearly level or gently undulating surface. They are bordered on the northern edge by the hilly prairie region just described, and on the southern by the hills of brown loam, or oak and pine region. The hills of the latter rise to a height of 200 feet above the general level of the flatwoods. These hills encroach upon the flatwoods in some places and recede from them in others, so that the width of the belt is quite variable. The hills are capped with the sand and other beds of the drift, but the laminated clays, which form the substratum of the flatwoods, are to be seen at the bases of most of them, and for several miles the hills have much the same characters as the flatwoods themselves, and might perhaps with propriety be included in this division.

The formation upon which the flatwoods and the adjoining hills are based is a heavy gray laminated clay belonging to the lower or lignitic division of the Tertiary. The flatwoods soil proper is the result of the disintegration of this clay. When wet by the rains, this clay becomes a tenacious, grayish, sticky mass, specked with red, which is in texture much like some of the clay of the prairie hills, but, unlike that, is rather deficient in lime.

The prevailing tree throughout the flatwoods is the post oak, of long, lank habit, but the short-leaf pine, and in places also the black-jack, are associated with it. The post-oak soils are tolerably well suited to the cotton-plant, which grows upon them to the height of 3 or 4 feet and yields from 600 to 800 pounds of seed-cotton to the acre when the land is fresh. From their texture, these soils are generally difficult to cultivate. There seems to be no subsoil, properly speaking, at least none differing essentially from the soil, which continues, without material change, to a depth of 10 or 15 feet, and passes gradually into the dark-gray laminated clay above spoken of. Two analyses of the flatwoods soils or clays and one of a subsoil have been made.

No. 25. *Post-oak flatwoods soil*, 4 miles west of Livingston, Sumter county, collected by Dr. R. D. Webb. Depth, 10 inches; vegetation, chiefly post oak, with some red oak, hickory, and short-leaf pine; color, gray, flecked with red.

No. 26. Subsoil of the above. Depth, 10 inches to 4 feet; color, also like the preceding.

No. 98. *Post-oak and flatwoods clay*, 6 miles south of Linden, Marengo county. Depth, 10 inches; vegetation, chiefly post oaks; color, reddish-yellow, spotted.

Flatwoods soils and subsoils.

	SUMTER COUNTY.		MARENGO COUNTY.
	Soil.	Subsoil.	Clay.
	No. 25.	No. 26.	No. 98.
Insoluble matter	67.020 } 77.070	79.662 } 84.693	72.746 } 81.672
Soluble silica	10.050 }	5.031 }	8.926 }
Potash	0.295	0.223	0.416
Soda	0.125	0.059	0.112
Lime	0.198	0.359	0.660
Magnesia	0.610	0.596	0.691
Brown oxide of manganese	0.115	0.073	0.106
Peroxide of iron	6.543	7.711	12.406
Alumina	10.198	3.308	2.473
Phosphoric acid	0.212	0.072	0.103
Sulphuric acid	0.027	0.026	0.061
Water and organic matter	5.031	2.356	1.906
Total	100.424	99.476	100.026
Hygroscopic moisture	13.040	12.341	13.941
absorbed at	28 C.°	9 C.°	8 C.°

Of the three analyses above given, No. 98 is perhaps the most characteristic; the others come from near the vicinity of the prairie region, and hence, especially the subsoil No. 26, have rather larger percentages of lime. The potash and phosphoric acid in the others are sufficient in quantity; lime is inadequate, but the large percentage of magnesia shown by all is noteworthy. The same may be noticed in the Mississippi flatwoods soils, and it seems to be characteristic. They are all deficient in vegetable matter, which appears to be a capital defect in all the flatwoods soils analyzed. The addition of lime and the plowing under of green crops and deep cultivation are at once suggested as a means of improvement of these soils, thorough drainage being first of all necessary.

THE LIME-HILLS OR LOWER PRAIRIE REGION.

This agricultural division embraces portions of Choctaw, Washington, Clarke, Monroe, Conecuh, Covington, Crenshaw, and Geneva counties, and occupies a belt which varies greatly in width, as may be seen by referring to the map. In the first-named four counties these prairie spots are more nearly continuous; in the others they appear only in detached bodies, often far apart. The area is put at 1,250 square miles.

From a geological point of view this subdivision includes that part of the state in which the calcareous portions of the Tertiary formation (especially the upper part of the Claiborne and the whole of the Jackson groups) lie at or near the surface. Over much of this territory the white limestone of the Vicksburg group is a conspicuous rock, but it extends also southward far beyond the limits above given, without producing limy or prairie soils. (*a*) The greater part of this area has the characters of the brown-loam uplands or of the pine hills, and it is only in the first and second bottoms and on the summits of the lower hills that the limy soils are to any extent encountered. The prairie or limy spots are interspersed in such a manner among the brown-loam and sandy pine lands that nothing short of a detailed map could show their actual occurrence. The tint on the map is therefore intended to show only the limits between which this kind of soil occurs at all.

Unlike the prairie region of the Cretaceous, there is in this region comparatively little level land, except upon some of the broader table-lands with brown-loam soils. These table-lands break off toward the water-courses in a series of hills, which are capped with pebbles and sand, and which are clothed with a growth of long-leaf pine and black-jack oak. Upon the table-lands the growth is long- and short-leaf pine and the usual variety of upland oaks.

The lower hills, as before stated, have here and there the peculiar black calcareous soil which gives the name to this region, and this soil extends usually to the bottom lands below, where it is, however, mostly tempered with the sandy washings from the uplands. The black prairie soils are generally quite fertile, and most of the hillsides, usually very steep where it occurs, are cleared and under cultivation. In its general features the country made by these rocks is very similar to the hill-prairie region of the Cretaceous.

In Choctaw and Washington counties, near the line of Mississippi, the lime-hills, or rather the prairie lands, are characteristic and numerous, occupying occasionally moderately level tracts of 100 acres or more. Toward the east, however, they diminish in frequency and continuous extent, and are seen no farther east than the lower part

a In the sequel the term "white limestone" is usually made to include both the white or grayish impure limestone of the Jackson group and the commonly purer orbitoidal limestone of the Vicksburg group. This use of the term is fully justified by the practice of the country where these rocks occur.

of Crenshaw county, except a small tract in the adjoining lower corners of Geneva and Henry; but long before this limit is reached the country bears almost exclusively the characters of the long-leaf pine hills, the limy soils being in small, detached bodies.

Soils.—The rock which gives rise to the peculiar soils of this division is an impure argillaceous limestone or calcareous clay stone, bearing often a considerable resemblance to the rotten limestone of the Cretaceous formation, as may be seen by reference to the subjoined analysis.

No. 137. *Impure argillaceous limestone* (Jackson), overlying the shell stratum at Claiborne, Monroe county.

In disintegrating the rock it yields a waxy, gray calcareous clay soil, which becomes black when mixed with vegetable matter. This soil is stiff and difficult to cultivate, but is very productive, and is quite similar to some of the prairie soils of the upper prairie region.

A second soil variety is of loose texture and black color, often full of small rounded fragments of the limestone, some of which are very soft and crumble easily between the fingers. The solid limestone is usually at a considerable depth from the surface. This soil, which characterizes the shell prairies, is one of the best of this division, and rarely fails to yield excellent crops, either of corn or cotton, and when fresh will produce nearly a bale of the latter to the acre. Occasionally loose shells, set free by the decay of the rock, abound in the soil, and it is not uncommon to find masses of these shells agglomerated into a compact and hard rock.

A specimen of this variety of soil from Mr. Robert A. Long's, Sec. 9, T. 8, R. 3 W., in Washington county, was analyzed with the following result:

No. 139. *Loose black-shell prairie soil*, Washington county. Depth, 8 inches; vegetation, dogwood, white and black oaks, sweet gum, ash, short-leaf pine, yellow wood, and buckeye bushes. The soil is loose, black, and full of soft crumbling fragments of limestone.

Impure argillaceous limestone and loose black soil of the lime-hills.

	MONROE COUNTY.	WASHINGTON COUNTY.
	Impure argillaceous limestone.	Loose black soil.
	No. 137.	No. 139.
Insoluble matter	28.394 } 31.314	21.655 } 23.409
Soluble silica	2.920 }	1.754 }
Potash	0.502	0.553
Soda	0.077	0.192
Lime	34.952	29.195
Magnesia	0.743	0.489
Brown oxide of manganese	0.156	0.113
Peroxide of iron	1.798	5.421
Alumina	1.159	5.155
Phosphoric acid	0.096	0.371
Sulphuric acid	0.290	0.463
Carbonic acid	27.471	22.177
Water and organic matter	2.207	12.845
Total	100.765	100.382
Hygroscopic moisture absorbed at		13.56 20.5 C.°

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A comparison of the above with the specimen of limestone will show that this soil is hardly anything more than the disintegrated limestone enriched with vegetable matter. The potash and phosphoric acid are much above the average, and the great fertility of this class of soil is easily understood. The large proportion of sulphuric acid suggests the presence of gypsum, which is not uncommon in very many of the soils and clays of this region.

A third variety of soil common in this region is a mixed one, resulting from the reaction of the limestone upon the red loam, which in places overspreads it. This is a stiff, waxy, reddish or chocolate-colored clayey material, difficult of cultivation, but fertile, and in most respects similar to the post-oak prairie soil of the upper prairie region, which it resembles not only in its mode of formation, but also in its timber, which is mostly post oak, associated with some short-leaf pine, hickory, sweet gum, and dogwood, all draped with long moss. The analyses given (No. 91) will show approximately the composition of the red-mixed soil.

A large proportion of the soils throughout this region, as has already been stated, are derived from the superficial beds of drift origin. The two analyses given on page 54 will show their general character.

No. 90. *Upland brown-loam soil*, 6 miles north of Gosport, Clarke county. Depth, 10 inches; vegetation, post, red, and Spanish oaks, short- and long-leaf pine, and some hickory; color, brown.

No. 91. *Underclay subsoil of No.* 90. Depth, 24 to 36 inches; vegetation, as above; color, yellowish-red.

The washings from the uplands often produce a lastingly productive soil, and this variety is common along the creeks of Conecuh county, especially Murder, Bottle, and the tributaries of the former.

No. 89. *Murder creek second-bottom soil*, 2 miles west of Evergreen, Conecuh county. Depth, 12 inches; vegetation, sweet gum, magnolia, white and water oaks, short-leaf and spruce pines; color, brownish-red.

Brown-loam soils and underclay of lime-hills region.

	Clarke county.		Conecuh county.
	Upland brown-loam soil.	Underclay subsoil.	Murder creek second-bottom soil.
	No. 90.	No. 91.	No. 89.
Insoluble matter	87.753 } 90.840	71.652 } 77.614	89.870 } 91.462
Soluble silica	3.087 }	5.962 }	1.592 }
Potash	0.140	0.350	0.140
Soda	0.010	0.048	0.016
Lime	0.096	0.326	0.094
Magnesia	0.066	0.091	0.018
Brown oxide of manganese	0.050	0.133	0.078
Peroxide of iron	1.999	7.408	2.385
Alumina	3.397	8.606	3.355
Phosphoric acid	0.120	0.295	0.122
Sulphuric acid	0.010	0.080	0.005
Water and organic matter	3.080	5.187	2.480
Total	99.808	100.138	100.155
Hygroscopic moisture	2.895	14.380	2.658
absorbed at	23 C.°	22 C.°	24 C.°

Nos. 90 and 89 are light loam soils of very fair quality, quite similar to each other, and are not materially different from the soils of the pine lands and oak and pine uplands, which may be consulted in this connection. No. 91, however, comes from a hillside below the level at which 90 was taken, where the sandy surface loam had been removed by washing rains, and in it we see the material which forms the soil of the lime-hills. Under cultivation this would become a black-prairie soil of great fertility. While it is not strictly a soil (having been taken from a wash several feet below the surface), the analysis gives us a fair idea of the character of the soils which give name to this region and of the material to which the deeper roots of cotton must often penetrate from the sandy surface.

THE LONG-LEAF PINE REGION.

In the region of the oak and pine uplands the sandy ridges are usually timbered with long-leaf pine, while the flat table-lands and some of the slopes and the second bottoms have the characteristic oak and hickory growth, with which some short-leaf pine and occasionally long-leaf pine are associated. As we go southward in this region of mixed growth the long-leaf pine becomes more prevalent, and is found both on the table-lands and in the low grounds, at first associated with the upland oaks, but farther south occupying the ground almost entirely in company with the black-jack, high-ground willow, and turkey oaks, and other trees, which are at home only upon the sandiest soils. At the same time the shrubby undergrowth gradually disappears almost entirely, and we are thus ushered into the open pine woods. Similarly with the topography, the hills of the preceding section gradually diminish in height and abruptness, and the country becomes undulating or rolling rather than hilly, and southward sinks away into the flat lands of the coast. The whole area of the long-leaf pine region, as thus limited, is about 7,790 square miles. The counties included are named below under the three subdivisions, which are in great measure based upon topographical characters. These subdivisions are:

The long-leaf pine hills.
The open, rolling pine woods, with lime-sinks.
The pine flats.

LONG-LEAF PINE HILLS.

In southeastern Mississippi the pine hills, which characterize the lower part of that state, flatten out eastward toward the Alabama line, thus forming a transition into our open, rolling pine woods. That part of Washington county to which the deep-green color of the pine hills has been given on the map does not differ essentially from that part which is designated as open pine woods, except in being more broken, and it is not necessary to give a separate account of its agricultural features, which are the same as those of the next succeeding division. The area of this pine hills or transition region, which is altogether in Washington county, is about 100 square miles.

ROLLING AND OPEN PINE-WOODS AND LIME-SINK REGION.

This region includes parts of the following counties: Washington, Mobile, Baldwin, Clarke, Monroe, Conecuh, Escambia, Covington, Coffee, Geneva, Dale, and Henry, and embraces an area of 6,570 square miles.

The territory here included is underlaid throughout by the white or orbitoides limestone of the Upper Eocene or Vicksburg age. The limestone, however, is in great measure covered with the sands and loams of a later period. Where this rock lies above the drainage level (which is more particularly the case in the southeastern part of the state, where the influence of the elevation of the Florida peninsula is felt) it is pitted with caverns and traversed by underground passages. The falling-in of the roofs of such caverns causes sinks or depressions, which are sometimes filled with water, forming lakes and ponds, and the subterranean waters, flowing through the channels above mentioned, emerge as big springs. In the southwestern part of the state the limestone sinks gradually away below the drainage level, and its influence on the topography is comparatively slight.

The prevailing surface material throughout the whole region, being sandy and more or less loose and porous, quickly absorbs the waters falling upon it, and the formation of deep gullies has thus been prevented, the face of the country being in general slightly rolling, with no great differences in elevation. In some places, especially within the drainage areas of the Chattahoochee and Alabama rivers and in the northern parts of this region, the admixture of red-clay loam with the sands brings about modifications both of the topography and of the soils, because of the varying degrees of resistance to denudation and the varying qualities of the admixtures of the two materials.

Upon the uplands throughout this region the prevailing growth is the long-leaf pine, associated with little or no undergrowth, but with black-jack, turkey, and high-ground willow oaks, and some hickories. Upon the sterile sandy ridges the growth is stunted, and scrubby oaks of several species are associated with the scrubby pines. The headwaters of the streams are found usually in slight depressions and swampy tracts, with a growth of magnolia, bay, gum, juniper, short-leaf pine, water oak, etc. The open swamps in the region have the richest and most varied herbaceous flora, some characteristic species of which have been given on page 57 in the floral list prepared by Dr. Charles Mohr.

The absence of all underbrush in many of the pine forests enables one to see for great distances between the straight trunks of the pines, and over the rolling land thus unobstructed by undergrowth a wagon may be driven in any direction without following any beaten track. The pines shade the ground comparatively little, and a great variety of grasses and leguminous plants flourish and give sustenance to herds of cattle and sheep. This region cannot be called a good farming country, though tolerably fair crops are raised in the more favored localities, such as low grounds. The raising of cattle gives support to many of the inhabitants, and the pines to many more, both in the lumber and the turpentine which they yield.

The prevailing soil of this region, as has already been said, is sandy, and of a gray or ash color. In the better spots the color is a dark gray. This is the soil of the better class of pine lands, and its composition may be seen from the subjoined analysis. With some assistance from fertilizers very fair crops of cotton and corn are produced.

No. 88. *Upland pine-woods soil*, 13 miles east of Andalusia, Covington county. Depth, 10 inches; vegetation, long-leaf pine, post, Spanish, black-jack, and high-ground willow oaks, with occasional small hickories; color, brownish-gray.

Upland pine-woods soil, Covington county.

	No. 88.	
Insoluble matter	90.815	92.390
Soluble silica	1.575	
Potash		0.170
Soda		0.036
Lime		0.085
Magnesia		0.032
Brown oxide of manganese		0.112
Peroxide of iron		1.143
Alumina		3.018
Phosphoric acid		0.111
Sulphuric acid		0.067
Water and organic matter		2.772
Total		99.936
Hygroscopic moisture		2.558
absorbed at		23° C.

This, considering the large proportion of insoluble matter, is a fairly good soil, though it is deficient in lime and magnesia. It resembles in composition many of the soils of Florida.

In places, especially along the drainage slopes of the Alabama and Chattahoochee rivers, the red loam occurs as substratum to the soils and subsoils, and frequently, by denudation, comes to form the surface. In this way

quite a variety of soils is produced, but they do not differ from similar soils of the brown-loam uplands, which result from the same admixtures. Occasionally the underlying limestone in its disintegration is mingled with the surface loam, and there results then a red limy soil of great fertility, similar to that of the red-lime lands of Jackson county, Florida. The best known tract of this kind of soil occurs along the Chipola river in Florida, and its northern extremity reaches up into the eastern part of Geneva and adjoining part of Henry county, Alabama. Of a similar nature are the red limy soils of the lowlands of Murder and Bottle creeks, in Conecuh county, which have been spoken of before in connection with the lime-hills region, to which they are contiguous.

The bottom lands of this region have, as a rule, light sandy but productive soils, which vary in quality with those of the uplands adjoining. The usual growth in the bottom lands consists of magnolia, bay, ti-ti, sweet-leaf, juniper, star anise, laurel, sweet shrub, etc.

THE PINE FLATS.

Toward the Gulf coast the rolling pine lands sink away into low pine barrens, in which the tree-growth consists of the long-leaf pine and the so-called Cuban pine, and with these a smaller growth of several species of ilex, etc. The low, wet margins of ponds support a varied and beautiful herbaceous growth, consisting of *Sarracenias*, *droseras*, *Catesby's lily*, and a number of others mentioned in the list of plants. The soil here is sandy and sour, little suited to cultivation, and cotton is not planted. The settlements are mostly confined to the vicinity of the streams.

The coast plain and the islands off the coast have generally a soil of drifting sands, destitute of timber, but supporting a few characteristic shrubs and lesser plants. The pine flats are limited to the lower parts of Mobile and Baldwin counties as a body, but low pine barrens of very similar nature are seen further inland. The area is put at 1,120 square miles.

ALLUVIAL REGION.

This includes the alluvial region of Mobile river and the saline marshes of the coast, and embraces parts of Washington, Mobile, and Baldwin counties, comprising an area of some 130 square miles.

ALLUVIUM OF MOBILE RIVER.

Below the junction of the Alabama and Tombigbee rivers the waters of these streams reach the bay of Mobile by several channels, the principal of which is the Mobile river, but the Tensas and Middle rivers and others diverge from the main stream, and form a kind of delta region, low, flat, and subject to overflow, generally covered with a growth of cypress. Near the bay this swamp assumes the character rather of a marsh, in which the courses of the streams are often nearly indistinguishable. These swamps are uncultivated, and have in the drier spots, besides the cypress, tupelo gum and several species of poplar, elms, palmetto, etc.

SALINE MARSHES OF THE COAST.

These are only found in the counties of Mobile and Baldwin. They are without timber, but have a herbaceous growth chiefly of rushes and sedges, which is characteristic. These plants are enumerated in the list referred to. The muck of decayed vegetable matter from the marshes may often be applied with profit to the sandy soils which adjoin them, and the marshes themselves in other states have sometimes been reclaimed for cultivation. The area of sea-marsh in Alabama, on account of comparatively limited extent of coast, is necessarily small, and few, if any, attempts have been made toward reclamation.

LIST OF TREES AND PLANTS CHARACTERISTIC OF EACH REGION OF THE STATE.

The following is a list, with botanical and common names, of some of the most important and characteristic trees and lesser plants of the various agricultural regions of the state, prepared by Dr. Charles Mohr, of Mobile:

I. *Lower pine region, or coast pine belt*, including—

a. The maritime plain, with saline marshes and flats, and dunes of drifting sands on the islands near the coast and on the sea-shore: Shrubs and trees—*Quercus virens* (live oak), var. *maritima*, and *Q. Phellos* (willow oak), var. *arenaria*, *Quercus virens* being the typical form on the inlets and bayous with higher banks and a more retentive soil; *Vitis incisa*, *Baccharis halimifolia*, *Lycium Carolinianum*, *Yucca aloifolia*. Herbs—*Chenopodium Boscianum*, *Chenopodina maritima*, *Salsola Kali*, *Sesuvium portulacastrum*, *Batatas maritima*, *Ipomœa Pes-Caprœ*, *Cyperus Le Contei*, *Uniola paniculata*, *Panicum repens*. In the saline or brackish marshes: *Baccharis halimifolia*, *Myrica cerifera* (candleberry), *Fimbristylis spadicea*, var. *castanea*; *Juncus Rœmerianus*, *Triglochin triandrum*, *Scirpus maritimus* (rush), *S. pungens*, *Brizopyrum spicatum*, *Statice Caroliniana*, *Gerardia maritima*, *Borrichia frutescens*, *Ipomœa sagittifolia*, *Batis maritima*, *Salicornia ambigua* (samphire), *Cakile æqualis*.

b. Open, grassy river swamps and wooded alluvial bottoms, more or less inundated: Open river swamps—*Zizania aquatica* (wild rice), *Scirpus lacustris* (round rush), *Phragmites communis* (reed), *Panicum virgatum*. Sedges—*Rhynchospora*, several species; *Cladium*, *Carex riparia*, *Cyperus stenolepis*, *C. Michauxianus*, *C. articulatus*, *C. haspan*, *C. virens*, several species of *Sagittaria* (arrowhead), *Cicuta maculata* (water hemlock), *Cacalia lanceolata*, *Gerardia purpurea*, var. *fasciculata*; *Aster flexuosus*, *A. divaricatus*, *Solidago sempervirens* (golden rod), *S. lanceolata*, *Hibiscus Moscheutos*, *Kosteletzkya Virginica*, *Lythrum lineare*. Shrubs—*Persea Caroliniana*, var. *palustris* (red bay); *Myrica cerifera*, *Salix nigra*, *Baccharis halimifolia*. Trees (forest swamps)—*Taxodium distichum*, the variety yielding the red cypress lumber; *Nyssa uniflora*, or tupelo gum; *Populus heterophylla*, *P. monilifera* (cottonwood), *Fraxinus viridis* (ash), *F. platycarpa*, *Persea palustris*, *Carya aquatica* (hickory), *Quercus aquatica* (water oak), *Ulmus alata* (wahoo), *U. Americana* (elm), *Catalpa bignonioides*, *Sabal Adansonii* (dwarf palmetto), *Ilex opaca* (holly), *I. decidua*.

c. Low flat pine barrens, or pine meadows: *Pinus Cubensis* (*P. Elliottii*, pine pitch), *P. australis* (long-leaf pine), *Ilex glabra* (gallberry), *I. Cassine* (yaupon), *Sarracenia* (pitcher-plants) of several species, *Drosera filiformis*, *D. brevifolia* (sundews), *Dichromena leucocephala* (white star-grass), *Eriocaulon*, several species (pipeworts), *Lachnanthes tinctoria*, *Aletris aurea* and *A. farinosa*, *Sabbatia gracilis* and *S. gentianoides* (American centaury), *Tofieldia pubens*, *Lilium Catesbæi*, *Zygadenus glaberrimus*, *Rhynchospora* in numerous species, largely prevailing with *Scleria oligantha*, *S. Elliottii*, and *S. Michauxii*; *Aristida spicata*, *Ctenium Americanum*, *Paspalum racemulosum* and *P. purpurascens*, *Panicum verrucosum*, *P. microcarpon*, and *P. ignoratum*; *Andropogon tener*, *A. Virginicus*, *A. macrourus*, and *A. scoparius* (broom-sedge); *Erianthus alopecuroides*, *Gratiola pilosa*, *Pinguicula lutea*, *Chaptalia tomentosa*, *Bartonia verna*, *Leptopoda fimbriata* and *L. brevifolia*, *Helianthus hetcrophyllus*, *Bigelovia nudata*, *Erigeron vernum*, several species of *Eupatorium*, *Aster dumosus*, *Liatris odoratissima* (vanilla plant), *L. graminifolia*, and *L. spicata*; *Carphephorus Pseudo-Liatris*, several species of *Ludwigia*, *Polygala ramosa*, *P. cymosa*, *P. cruciata*, *P. Chapmanii*, and *P. Hookerii*; *Linum rigidum*, *Hibiscus aculeatus*, *Hypericum cistifolium*, *H. myrtifolium*, and *H. fasciculatum*.

d. The evergreen glades of the hummock lands and wooded bottoms, more or less sphagnous, with the open swamp bordering upon them: Trees and shrubs—*Magnolia grandiflora* (bull bay), *M. glauca* (bay), *Persea Caroliniana* and its variety *palustris*, *Nyssa Caroliniana*, *Cliftonia ligustrina* (the ti-ti), *Olea Americana*, *Symplocos tinctoria* (sweet-leaf), *Calycanthus lævigatus* (sweet shrub), *Myrica inodora*, *Cupressus thyoides*, or juniper, *Pinus Elliottii*, *P. Tæda* (loblolly pine), *Quercus aquatica* (water oak), *Oxydendrum arboreum*, or sourwood, *Zanthoxylum Clava-Herculis* (prickly ash), *Illicium Floridanum* (star anise), *Ilex coriacea*, *I. Cassine* (yaupon), *I. ambigua*, *I. Dahoon*, *Rhus venenata* (poison elder), *Vaccinium virgatum* and *V. myrsinites* (huckleberries), *Halesia diptera* (snow-drop tree), *Cyrilla racemiflora*, *Bumelia lanuginosa*. In the open swamps: *Sarracenia rubra*, *S. flava*, *S. Drummondii*, *S. Psittacina* (pitcher-plants), *Sabbatia macrophylla*, *Asclepias paupercula* (marsh milkweed), *Tiedemannia teretifolia*, *Lophiola aurea*, *Calopogon pulchellus*, *Pogonia* (several species), *Xyris*, and most of the plants mentioned above as inhabiting the bogs of the pine meadows; *Rhynchospora* (several species), *Paspalum præcox*, *Panicum gibbum*, *Curtisii*, *virgatum*, and *P. proliferum*, *Rottbœllia rugosa*. As taking possession of the waste lands, or the cultivated soils, the following are to be mentioned: *Cyperus rotundus* (nut-grass), *C. repens*, *C. Baldwinii*, *Panicum sanguinale*, or crab-grass, *Cynodon Dactylon* (Bermuda grass), several troublesome bind-weeds, such as *Ipomœa commutata* and *I. lacunosa* (morning-glory), *Sesbania macrocarpa* and *vesicaria*.

e. The rolling pine lands, covered with forests of *Pinus australis*, and almost devoid of undergrowth: *Quercus cinerea* (narrow-leaf black-jack or high-ground willow oak), *Q. nigra* (broad-leaf black-jack, or simply black-jack), *Q. Catesbæi* (forked-leaf black-jack, turkey oak), *Carya tomentosa* (mockernut hickory), *Ceratiola ericoides*, *Sabal serrulata* (saw palmetto), *Asimina parviflora* (dwarf papaw), *Yucca filamentosa* (bear-grass), several species of *Rhynchospora* preferring a sandy, dry soil, such as *R. Grayii*, *R. compressa*, etc. Of grasses: *Danthonia sericea*, *Aristida lanata*, *Sporobolus junceus*, *Eatonia filiformis*, *Paspalum racemulosum*, *P. Floridanum*, *Panicum rufum*, *P. depauperatum*, and *P. dichotomum*, in varieties; *Andropogon Elliottii* and *A. scoparius* (broom-sedge), *Sorghum nutans*, *Brevoria*

humistrata, *Rhynchosia tomentosa* in all its varieties, *R. galactioides*, *Lupinus diffusus* and *L. villosus*, *Galactia sessiflora*, *Rhexia glabella* (deer-tongue), *Chrysobalanus oblongifolius*, *Apium divaricatum*, *Tetragonotheca helianthoides*, *Vernonia angustifolia* (iron-weed), *Sericocarpus tortifolius*, *Liatris elegans*, *L. squarrosa* (rattlesnakes' master), *Helianthus radula*, *Coreopsis senifolia*, *Aster adnatus* and *A. patens*, *Gaillardia lanceolata*, *Eupatorium aromaticum*, *Asclepias Michauxii* and *A. amplexicaulis* (milkweeds), *Sabbatia brachiata* (centaury), *Gerardia Plukenetii*, *G. Skinneriana*, *Ruellia ciliosa*, *Kalmia hirsuta*, *Buchnera elongata*.

Among the weeds of the fields and gardens are prominent *Richardsonia scabra*, or Mexican or Florida clover, crab-grass, *Cassia nictitans*, *Polypremum procumbens*, *Ambrosia artemisiæfolia* (hogweed), and *Erigeron Philadelphicum* (rag-weed).

II. *Region of mixed tree growth, or upper pine region*, including—

a. The lowland, with its heavily-wooded river valleys and creek bottoms. Predominating trees: *Pinus australis*, *P. glabra* (spruce pine), *P. Tæda*, *Cupressus thyoides* (white cedar), *Quercus Michauxii*, Nutt. (swamp chestnut-oak, *Q. Prinus bicolor* of Michx.), *Q. lyrata* (overcup oak), *Q. alba* (white oak), *Q. falcata* (Spanish oak), *Q. rubra* (red oak), *Q. aquatica* (water oak), *Carya alba* (shell-bark hickory), *C. tomentosa* (mockernut), *C. aquatica* (water bitternut), *C. porcina* (pig-nut), *Celtis Mississippiensis* (hackberry), *Planera aquatica*, *Platanus occidentalis* (sycamore), *Ulmus Americana* and *U. alata*, *Persea Caroliniana*, *Fraxinus Americana* (white ash), *Acer rubrum* (red or swamp maple), *Negundo aceroides* (ash-leaf maple), *Prunus Americana* (red plum), *Tilia Americana* (basswood, linden), *Liquidambar styraciflua* (sweet gum), *Gleditschia triacanthus* (honey-locust), *Ilex opaca* (holly), *Magnolia grandiflora*, *M. acuminata*, *M. macrophylla* (large-leaf bay), *M. Fraseri* (umbrella trees, cucumber trees), *Bumelia lycioides*, *Rhamnus Caroliniana* (buckthorn), *Cratægus spathulata*, *C. apiifolia*, and *C. aestivalis* (haws), *Illicium Floridanum* (star anise), and *Catalpa bignonioides*.

b. Uplands and so-called wooded prairies or post-oak flatwoods: *Quercus tinctoria* (black oak), *Q. obtusiloba* (post oak), *Q. nigra* (black-jack), *Q. falcata* (Spanish oak), *Q. rubra* (red oak), *Carya tomentosa*, *C. amara* (bitternut), *C. porcina*, *Ostrya Virginica* (hop hornbeam), *Castanea pumila* (chincapin), *Æsculus parviflora* (buckeye), *Thalictrum anemenoides*, var. *debile*, *Hepatica triloba* (liver-leaf), *Ranunculus abortivus*, *Zanthorhiza apiifolia* (yellow root), *Calycocarpum Lyonii*, *Viola pedata*, var. *bicolor*, *Hypericum galioides* (in swamps), *Stellaria pubera*, *Silene Virginica*, *Sida Elliottii*, *Habenaria tridentata*, *Geranium maculatum*, *Hydrangea arborescens*, *H. quercifolia* (seven bark), *Philadelphus grandiflorus*, *Stokesia cyanea*, *Callirrhoë Papaver*, *Calamintha Caroliniana*, *Onosmodium Virginianum* and *O. Carolinianum*, *Phacelia pusilla*, *Phlox paniculata*, *Sabbatia chloroides*, *Acerates paniculata*, *Aristolochia tomentosa* (tobacco-pipe), and *Gonolobus hirsutus*. Many of the grasses which are common in the region below occur also here: *Uniola latifolia*, *Bromus ciliatus*, *Arrhenatherum avenaceum*, *Poa flexuosa*. As weeds, besides those above mentioned, the following are common: *Xanthium strumarium* (cocklebur), *Bidens bipinnata* (Spanish needles), *Polygonum*, several species (smartweed), all growing in low rich spots; *Amarantus chlorostachys*, *A. hybridus*, and *A. spinosus* (careless weeds), *Portulaca oleracea* (purslane), *Lepidium Virginicum* (pepper cress), *Specularia perfoliata*, several species of *Cerastium* and *Stellaria* (chickweeds), *Maruta Cotula* (dog fennel), *Helenium augustifolium* (bitter-weed), and several species of *Rubus* (blackberry or bramble).

III. *The Cretaceous plain*, with the so-called bald and wooded prairies of the black belt.

The growth is mostly the same as that of the division adjoining it below. *Quercus Phellos* is here found more frequently and in its best development.

This region is bounded on the north by the interior long-leaf pine region of the central drift belt. Many of the trees and shrubs, such as *Illicium Floridanum* and *Magnolia grandiflora*, occur here, finding their northern limit. The flora of the prairies is similar to that of the grassy plains of the northwestern states east of the Mississippi, with coarse *Silphium*, or rosin-weed (*S. laciniatum* and *S. lævigatum*), *Rudbeckia triloba*, late *Helianthi* (sunflowers), such as *H. atrorubens*, *H. mollis*, *H. tomentosus*, with others; *Lepachis pinnata*, *Petalostemon candidum*, and *P. carneum*; *Schrankia uncinnata*, *Desmanthus brachylobus*, in swamps; *Brunnichia cirrhosa*, *Hibiscus incanus*, *Cacalia ovata*, in copses and wooded banks; *Pycnanthemum linifolium*, *Penstemon digitalis*. Of shrubs, *Prunus umbellata*. Among the grasses *Paspalum distichum* and the crab-grass (*Panicum sanguinale*) are troublesome weeds in the cotton-fields of the black lands; also the various species of *Cassia—occidentalis*, *obtusifolia*, and *Marilandica*.

IV.—*The Mountain region of northern Alabama* to the valley of the Tennessee river, including the oak forests of the metamorphic region. In these *Quercus rubra*, *Q. tinctoria*, and *Q. falcata* greatly predominate.

On the high lands or extensive table-lands of the Carboniferous sandstone the following trees are found: *Pinus australis* (in patches), *P. mitis* (short-leaf pine), *P. Tæda* (loblolly pine), *P. inops* (here called mountain pine), *Quercus coccinea* (scarlet oak), *Q. Prinus* (the mountain or tan-bark oak), *Q. Muhlenbergii*, *Q. nigra*, *Q. rubra*, *Q. obtusiloba*, with *Castanea vesca*, var. *Americana* (the chestnut), more or less stunted hickories and poplars, and the very common *Oxydendrum arboreum*. *Azalea nudiflora* in several forms, *Magnolia acuminata* and *M. cordata*, the butternut (*Juglans cinerea*), *Magnolia umbrella*, and *M. macrophylla* take to the richer slopes and valleys, along with *Tilia heterophylla* and *T. Americana* (the basswoods or lindens), *Ulmus fulva* (slippery elm), poplar (*Liriodendron*), black walnut (*Juglans nigra*), and *Ilex mollis*.

Herbs and shrubs: *Delphinium azureum* and *D. uncinnatum*, *Sanguinaria Canadensis* (blood-root), *Dentaria* (several species), *Thalictrum dioicum*, *T. clavatum*, *Viola blanda*, *V. canina*, var. *sylvestris*, *V. pubescens*, *Hypericum*

aureum*, *Arenaria patula*, *Silene regia*, *Polygala Boykinii*, *Rosa lucida (wild rose), ***Pyrus coronaria*** (crab-apple), ***Calycanthus floridus*** (sweet shrub), ***Neviusia Alabamensis*, *Croton Alabamensis*, *Sedum Nevii*, *S. pulchellum*, *Heuchera Americana*** (alum-root), ***Saxifraga Virginiensis*, *Tiarella cordifolia*, *Hydrangea radiata*, *Sericocarpus conizoides*, *Aster Shortii*, *Solidago Curtisii*** and ***S. amplexicaulis*, *Silphium compositum*, *Parthenium integrifolium*, *Rudbeckia mollis*, *Phacelia bipinnatifida*, *Phlox divaricata*, *Silene rotundifolia***, and ***Campanula divaricata.***

Upon the limestone belts of the valleys and the slopes bordering on them are found groves of red cedar (***Juniperus Virginiana***), and on deep rich soils large poplars (***Liriodendron***), black walnut, ash, and white oaks. In the basin of the Tennessee river are found, of forest trees, all those of a more northern range mentioned before, together with shrubs or small trees like the ***Æsculus glabra*** and ***flava*, *Fraxinus quadrangulata*, *Rhus cotinoides***, and ***Forestiera acuminata.*** Black walnut, poplars, white hickory, and white ash are most frequent.

REMARKS ON COTTON PRODUCTION IN ALABAMA.

[The weight of the bale, as used in this report and in the tables, is 475 pounds, and in all the discussions and comparisons the proportion of lint or fiber to seed-cotton is assumed to be as 1 to 3.]

In total production in the United States Alabama stands No. 4, being below Mississippi, Georgia, and Texas; and in product per square mile Alabama also occupies the fourth place, producing 13.6 bales to the square mile, below Mississippi with 20.5 bales, South Carolina with 17, and Georgia with 13.8.

Some of the most prominent facts connected with the production of cotton in Alabama are set forth in the results of the enumeration presented in tabular form below. From these tables certain inferences may be drawn which are of interest, as showing where the cotton is produced, by whom, and what effect the continuous cultivation of cotton has upon the fertility of the soil.

TABLE III.—SHOWING POPULATION AND COTTON PRODUCTION IN EACH AGRICULTURAL REGION OF THE STATE.

Agricultural regions.	Area in square miles.	POPULATION.			COTTON PRODUCTION.									
							Average per acre.				Total in tons.		Percentage of state's total production.	Cotton acreage per square mile.	Bales per square mile.
		Total.	White.	Colored.	Acres.	Bales.	Fraction of bale (475 pounds).	Seed-cotton.	Lint.	Seed.	Lint.	Seed.			
Total	51,540	1,262,505	662,185	600,320	2,330,086	699,654	0.30	429	143	286	166,168	332,336	100	45	14
Metamorphic region	4,460	129,705	85,072	44,633	236,745	71,285	0.30	429	143	286	16,930	33,860	10	53	16
Coosa valley region	3,930	109,155	78,178	30,977	131,505	52,699	0.40	570	190	380	12,516	25,032	8	33	13
Coal Measures region	5,070	85,938	77,032	8,956	62,863	21,692	0.35	498	166	332	5,152	10,304	3	12	4
Tennessee valley region	5,760	168,502	107,157	61,345	260,861	84,447	0.32	456	152	304	20,056	40,112	12	45	15
Oak and hickory uplands, with short-leaf pine	3,060	53,120	36,813	16,307	87,496	28,806	0.33	471	157	314	6,841	13,682	4	29	9
Gravelly hills, with long-leaf pine	3,990	75,847	42,898	32,949	122,587	37,229	0.30	429	143	286	8,842	17,684	5	31	9
Central prairie region	9,220	376,061	87,877	288,184	1,014,606	278,508	0.27	384	128	256	66,146	132,292	40	110	30
Oak and hickory uplands, with long-leaf pine	9,470	186,633	99,871	87,262	399,357	120,789	0.30	429	143	286	28,676	57,352	17	42	13
Long-leaf pine region	6,580	77,494	47,787	29,707	14,066	4,249	0.30	429	143	286	1,009	2,018	1	2	1

TABLE IV.—SHOWING "BANNER" COUNTIES AS REGARDS TOTAL PRODUCTION AND PRODUCT PER ACRE IN THE VARIOUS AGRICULTURAL REGIONS OF THE STATE.

Regions according to product per acre.	Average product per acre, fraction of bale (475 pounds).	COUNTY IN EACH REGION HAVING HIGHEST TOTAL PRODUCTION.						COUNTY IN EACH REGION HAVING HIGHEST PRODUCT PER ACRE.					
		Name.	Rank in product per acre in the state.	Cotton acreage.	Total production in bales.	Product per acre, fraction of bale.	Rank in total production in the state.	Name.	Rank in total production in the state.	Cotton acreage.	Total production in bales.	Product per acre, fraction of bale.	Rank in product per acre in the state.
Coosa valley region	0.401	Talladega	11	32,841	11,832	0.360	24	Cherokee	28	24,388	10,777	0.442	2
Coal Measures region	0.345	Marshall	27	16,412	5,358	0.326	44	De Kalb	56	7,469	2,859	0.383	7
Oak and hickory uplands, with short-leaf pine.	0.329	Pickens	26	52,651	17,283	0.328	14	Fayette	52	12,331	4,268	0.346	19
Tennessee valley region	0.324	Madison	47	72,838	20,679	0.284	10	Limestone	16	44,334	15,724	*0.355	14
Gravelly hills, with long-leaf pine	0.304	Tuscaloosa	24	33,773	11,137	0.330	25	Tuscaloosa	25	33,773	11,137	0.330	24
Oak and hickory uplands, with long-leaf pine.	0.302	Wilcox	18	77,076	26,745	0.347	4	Wilcox	4	77,076	26,745	0.347	18
Long-leaf pine region	0.302	Washington	8	3,280	1,246	0.380	59	Baldwin	62	1,384	638	0.461	1
Metamorphic region	0.301	Chambers	54	70,934	19,476	0.275	11	Cleburne	54	9,156	3,600	0.393	6
Central prairie region	0.274	Dallas	45	115,631	33,534	0.290	1	Lowndes	3	98,200	29,356	0.299	41

* Colbert has the same product per acre as Limestone.

BANNER COUNTIES OF THE STATE.—As regards total production—Dallas, 33,534 bales; as regards product per acre (omitting those whose product is less than 100 bales)—Baldwin, 0.461 bale; as regards percentage of tilled land in cotton—Russell, 61 per cent.; as regards cotton acreage per square mile—Montgomery, 152 acres; as regards bales per square mile—Montgomery, 43 bales.

DEPARTMENT OF THE INTERIOR.

TENTH CENSUS OF THE UNITED STATES

MAP
OF
ALABAMA
SHOWING
IN THE DIFFERENT SECTIONS OF THE STATE
THE RELATION BETWEEN THE
AREA CULTIVATED IN COTTON
AND THE TOTAL AREA
BY
EUGENE A. SMITH, PH.D.
SPECIAL AGENT 10TH CENSUS
1880.

LEGEND.

Percentage of total area planted in Cotton in 1880.

I	0 to 0.1 per cent.
II	0.1 to 1 " "
III	1 to 5 " "
	5 to 10 " "
	10 to 15 " "
	15 to 20 " "
	20 per cent and above.

Scale

25 0 25 50 75 100 MILES

Julius Bien & Co. lith.

AREAS OF GREATEST PRODUCTION.—A statistical map accompanies this report which shows in each region the percentage of the total area planted in cotton; and since the differences in product per acre in the several agricultural regions are comparatively slight, this map shows also approximately the percentage of the whole crop produced in each region.

Upon examination of this map, or of the statistical tables given on page 60, we see that the central prairie region produces 40 per cent. of the entire cotton crop of the state, the oak, hickory, and long-leaf pine region 17 per cent., the Tennessee valley 12 per cent., the metamorphic 10 per cent., the Coosa valley 8 per cent., the gravelly hills 5 per cent., the short-leaf pine uplands 4 per cent., the Coal-measures region 3 per cent., and the long-leaf pine region less than 1 per cent. But these relations will be much more clearly shown if we take into consideration also the relative areas of these regions and rate them according to the number of bales to the square mile. The several regions will then rank as follows:

	Bales to the square mile.
1. Central prairie region	30
2. Metamorphic region	16
3. Tennessee valley region	15
4. Coosa valley region	13
5. Oak, hickory, and long-leaf pine region	13
6. Oak, hickory, and short-leaf pine region	9
7. Gravelly hills	9
8. Coal Measures	4
9. Long-leaf pine region	1

By this arrangement we are able to recognize three well-defined areas of large production in the state. These are: 1, the central cotton belt; 2, the Tennessee valley; 3, the Coosa valley. The first of these areas produces at least 60 per cent. of the cotton crop; the second, 12 per cent.; the third, 8 per cent.; while the remaining 20 per cent. is produced by the rest of the state.

The nucleus of the central cotton belt is composed of the 12 counties of the prairie region, together with Chambers and Lee counties and the southern portion of Tallapoosa county, of the metamorphic region. On each side of this nucleus there is a margin consisting of the adjacent portions of the counties of the short-leaf pine uplands and gravelly hills on the north, and of the oak, hickory, and long-leaf pine uplands on the south, in which the cotton production assumes nearly as great proportions as in the prairie belt itself. In this way are included the southern parts of Pickens, Tuscaloosa, Autauga, and Elmore counties, and the northern parts of Wilcox, Butler, Crenshaw, Pike, and Henry counties.

The width of this central cotton belt across the state is not much less than 75 miles, and the cotton production throughout the area thus defined is 20 bales and upward to the square mile.

Of the counties which form the nucleus of the central cotton belt Dallas has the largest total production, because of its greater area; but if we take into account the differences of area, Montgomery occupies the first place, producing 43 bales to the square mile. After Montgomery come Lowndes with 40 bales, Dallas and Bullock with 34 each, Chambers with 32, and so on down the list, ending with Tallapoosa, which has 17 bales to the square mile. It will be seen by reference to the tables that some of the marginal counties of this central belt show a yield for the whole county of 20 bales and upward to the square mile, which would, of course, bring up the yield of the portion of the county actually embraced in the central region.

The second well-marked area of large production is found in the Tennessee valley, with its greatest intensity along the immediate valley of the river, and the relative importance of the several counties here included in the production of cotton may be approximately measured by the relative proportion of the red or valley lands in the area of each. Applying the test of area devoted to cotton, we find that the counties rank as follows: Madison, Limestone, Lawrence, Lauderdale, Colbert, Jackson, Morgan, and Franklin; but in eliminating the disturbing influence of difference in area, and taking account also of the product per acre, their rank as regards the number of bales to the square mile becomes: Limestone, Madison, Lawrence, Colbert, Lauderdale, Morgan, Jackson, and Franklin. Of these counties only the first two produce over 20 bales to the square mile.

The third large cotton-producing area is the Coosa valley. In actual production to the square mile this falls behind the other two regions, being 13 bales, while that of the Tennessee valley is 15, and that of the central cotton belt 20 bales and upward. Both in total production and in cotton acreage, and especially in the number of bales to the acre, the counties of this region fall behind those of the two preceding. Talladega county stands first, with 17 bales to the square mile; then come Calhoun, Cherokee, Etowah, Saint Clair, and lastly Shelby, with 9 bales.

We have thus seen where the great proportion of the cotton crop of Alabama, 80 per cent., is produced. As regards the rest of the state not much more need be said, except concerning the Coal Measures and the long-leaf pine regions, which show a production of 4 bales and 1 bale respectively to the square mile. With regard to the former region, it is to be remarked that the greater part of the cotton is produced in the valleys which traverse it, and not upon the soils of the true Coal Measures. Winston and Cullman may be taken as fair representatives of this region.

POPULATION AND COTTON PRODUCTION.—Taking the state as a whole, the cotton production of Alabama is 0.55 bale to the inhabitant, or little more than a bale for every two inhabitants. This proportion varies in the

different agricultural regions. In the Tennessee valley and the gravelly pine hills the proportion is exactly a bale to two inhabitants; in the short-leaf pine uplands the proportion is a little more than a bale to two inhabitants, and in the Coosa valley it is slightly less. In the central prairie region the proportion is a bale and a half, and in the oak, hickory, and long-leaf pine uplands a bale and a quarter to every two inhabitants. In the last-named region, however, there are parts of some of the counties immediately adjoining the prairie region in which the same proportion probably obtains as in the prairie region itself. The same is true of the counties of Chambers and Lee; so that for the great central cotton belt the proportion is about three-fourths of a bale to the inhabitant.

Following out these relations a step further, we find that over 55 per cent. of the colored population of the entire state is to be found in the central cotton belt, where about 60 per cent. of the cotton is produced. Something over 10 per cent. of the blacks are found in the second cotton area, the Tennessee valley, and about 5 per cent. in the Coosa valley. This accounts for more than 70 per cent. of the colored population, which is thus concentrated in the three large cotton-producing areas of the state, where about 80 per cent. of the cotton crop is produced.

The distribution of the whites in the same regions is as follows: In the central cotton belt, about 18 per cent; in the Tennessee valley, about 16 per cent.; and in the Coosa valley, about 12 per cent.; thus accounting for about 46 per cent. of the white population, as inhabiting the three large cotton-producing areas, against 70 per cent. of the blacks in the same areas. The other regions of the state which produce the remaining 20 per cent. of the cotton support 54 per cent. of the white population, but less than 30 per cent. of the blacks. Since the proportion of the white to the black population in the whole state is about 1.1 to 1, or not far from equal, it seems to follow that the greater part of the cotton crop of Alabama is produced by the negroes.

PRODUCT PER ACRE AND ITS RELATION TO POPULATION.—In product per acre Alabama stands No. 13 of the fourteen principal cotton-producing states of the Union. Other things being equal, the product or yield per acre may be taken as an index to the fertility of a soil, and if we apply this test to the several agricultural regions of Alabama they take the following rank:

1, Coosa valley; 2, Coal Measures; 3, oak, hickory, and short-leaf pine uplands; 4, Tennessee valley; 5, gravelly hills; 6, oak, hickory, and long-leaf pine uplands; 7, long-leaf pine region; 8, metamorphic; and 9, central prairie region.

Putting Chambers and Lee together with the counties which constitute the *prairie region*, we have the nucleus of the central cotton belt as above defined. In all these counties the average product per acre is 0.27 of a bale. This somewhat unexpected result cannot be considered as due to the relative infertility of the soils of this belt, for correspondents unite in giving as the average yield on the fresh lands of this region from 700 to 1,600 pounds of seed-cotton, or from one-half a bale to more than a bale to the acre, and the chemical analyses show that these soils in their virgin state are among the very best in the state. We are led, therefore, to the conclusion that the soils of the great cotton belt have been exhausted by improvident culture, and, as a matter of fact, we know that in many parts of this belt cotton is planted year after year upon the same soils without rotation with other crops, and without an attempt at maintaining the fertility by the use of manures. In the other parts of the state where cotton is produced a selection is generally made of the better soils, rotation of crops is more generally practiced, and in some sections fertilizers are in more general use.

That the character of the laborers and the system of farming practiced are largely concerned in determining the yield cannot, on general principles, be denied, and we find ample proof that these two things are responsible in no small degree for the results above shown.

The *central cotton belt* is generally a region of large farms or plantations, in which the laborers are chiefly negroes, as seen in the tables. As a rule, these laborers do not own the land, have no interest in it beyond getting a crop from a portion of it, which they rent either for a sum of money or for a share of the crop, and are not interested in keeping up the fertility, at least not to the extent of being led to make any attempts at the permanent improvement of the same. In the case of the owner of the land, while the conditions are different, the result is the same. He is, of course, interested in the improvement of his land; but to supply the fertilizers for a large plantation, when he cultivates it by hired labor, would cost more than he usually has to expend, and where the share system, or that of renting, prevails he is still further removed from personal care of the land; and thus from all causes there is an exhaustive cultivation of the land, without any attempt at maintenance or restoration of its lost fertility.

In addition to these, the system of advances or credit, so prevalent throughout the cotton-producing parts of the state, is not without its evil influence, for the laborer, and too often the owner of the land, is obliged to get advances of provisions from their merchants, for the payment of which the crop is mortgaged; and as cotton is the only crop which will always bring ready money, its planting is usually insisted on by the merchants making the advances and selected by the farmer as a means of providing for payment. In this way cotton comes to be the paramount crop, and there is little chance for rotation with other things.

In this connection it will be instructive to read the reports given under Part III, treating of cultural details. It will there be seen that the system of credits in the large cotton-producing regions prevails to such an extent that the whole cotton crop is usually mortgaged before it is gathered; and when we consider that the prices charged for provisions, etc., thus advanced are at least 50 per cent. higher than regular market rates, and that the cost of

producing cotton is given by our correspondents, almost without exception, at 8 cents a pound, it will need very little calculation to show that the laborer who makes a profit of only 2 or 3 cents a pound or $12 to $15 a bale on his cotton will have the chances too greatly against him ever to be out of debt to his merchants when he relies solely upon this crop to provide the money; and the exorbitant interest on the money advanced is not likely to be lessened so long as the merchants' risks continue to be as great as they are.

In the *Tennessee and Coosa valleys*, which are also large cotton-producing sections, a similar state of things may be observed. In Madison and Talladega counties the blacks outnumber the whites, and in both we find the product per acre falling far below the average of the region in which they are situated. Thus Madison shows a product of 0.28 bale, against the average of 0.32 for the whole Tennessee valley, and Talladega a product of only 0.36 bale, when the average for the Coosa valley region, of which it is a part, is 0.40. Wherever the black population is in excess of the white we may take it for granted that the system of large farms rented out to the negroes prevails, and the inevitable result of this system of farming thus becomes apparent in these sections also.

In the other agricultural regions of the state, and in most of the counties also of the Tennessee and Coosa valleys, the farms are, as a rule, small, and are cultivated by their owners, with the assistance of such labor as may be hired from time to time. In all these cases provisions are produced on the farm, and cotton is planted as a secondary crop. There is thus some chance for selection of the soils and for rotation of crops; and when a man cultivates his own farm fertilizers are in more general use, so that even with soils naturally much inferior to those of the main cotton-producing regions the average product per acre is much higher in these regions of small production.

In the *Coal-Measures* region, which takes rank as third in product per acre, there are no large farms, and the whites outnumber the blacks nearly 9 to 1 (a sure sign of poor soil), the farmers generally owning the land which they cultivate.

Until very recently only the lands of the valleys traversing the Coal Measures have been planted in cotton, so that the product per acre as given in the tables is an index rather of the fertility and capabilities, under proper culture, of the calcareous valley soils than of those directly derived from the rocks of the Coal Measures. In Winston and Cullman there are no valley soils, hence the product per acre of these counties may be taken as representing that of the soils of the Coal Measures generally, viz, 0.26 to 0.28. In these regions it is usual to plant only the better kinds of soils in cotton, and of late only with the application of some kinds of commercial fertilizers. These sandy lands, which have a clayey substratum, are more and more every year, with moderate quantities of fertilizers, coming into use in the production of cotton, and the same may also be said of the siliceous portions of the valley lands of the regions just spoken of. It is now thought to be pretty well established that these poorer sandy lands, with the aid of moderate quantities of fertilizers, make in the long run better-paying and more certain crops of cotton than the intrinsically better classes of soils without the fertilizers.

In the *short-leaf pine upland* counties the whites are more than twice as numerous as the blacks. The same conditions, therefore, hold here as in the case just mentioned. The product per acre is 0.33 per bale.

The soils of the *gravelly hills* are practically the same as those of the short-leaf pine lands, but the product is 0.30 bale to the acre, and that of the oak, hickory, and long-leaf pine uplands about 0.30, with likewise very similar soils. In these the two races are present in nearly equal proportions. These figures furnish an additional illustration of what has been shown above, viz, that the greater the proportion of blacks among the population the more prevalent will be the system of large farms worked on shares or by renting and the smaller will be the yield of the land so cultivated, because of the inherent vices of the system.

The concentration of the black population in the great farming regions of the state, which are also the regions of the originally most fertile soils, is amply shown by Table III; and so closely does this class of the population follow the best lands that the density of the colored population of any region might almost be taken as an index of the fertility of its soils. The white population is much more evenly distributed over good and poor lands alike, so that the proportion between the two races varies with the fertility of the soils. (*a*)

If we examine any county whose product per acre falls below the average of the region of which it forms a part, we shall find almost without exception that this is due either to the improvident culture which invariably attends the system of large farms (and the prevalence of this system is almost invariably shown by the preponderance of negroes among the population) or to the comparative infertility of the soil, as may be inferred from the preponderance of the whites. Thus in the county of Marion, in the short-leaf pine uplands, we find the product only 0.31, and we see that the county is inhabited almost entirely by white men. Again, in Pickens, there is a slight falling below the average, and here we find one-third more negroes than whites (large farms and bad culture).

In the *gravelly hills region* Autauga falls below the average, notwithstanding it possesses some of the best second-bottom lands of the Alabama river. In this county the negroes outnumber the whites two to one.

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a The negroes were originally brought together upon these great cotton-producing areas as the slaves of the wealthy planters who bought up the greater part of the best lands in the state. Since the war they have remained, practically speaking, in the same places where as laborers in the cotton-field (with which they were most familiar) they could always be sure of employment and of a good living without too severe labor. The social attractions also of these great centers of negro population have not been without their influence in keeping the race together. 73

In the *oak, hickory, and long-leaf pine region* we meet with some exceptions to the general rule. Most of these, however, admit of explanation. Thus, Choctaw follows the rule: excess of blacks, below the average of product per acre. Clarke, Monroe, and Wilcox form exceptions: large negro population and high product per acre. This finds its explanation in the fact that the cotton lands of those three counties are either the very best of river lands, such as form Black's bend, in Wilcox, or the equally fertile lime-hills or black-shell prairie lands, like those in the vicinity of Limestone and Flat creeks, in Monroe. Butler and Pike follow the rule: excess of white population, small farms, better cultivation, general use of fertilizers, all of which combine to bring up the product per acre above the average for the region. The lower counties, such as Conecuh, Coffee, Dale, and Henry, lie within the limits of the long-leaf pine region, where the poverty of the soil is more than an offset to the better cultivation practiced on small farms. Conecuh has also a large negro population on some of its best lime-lands to keep down the average product.

In the counties of the *open piny woods* there is comparatively little cotton produced, not much more than 1,000 bales in any of the counties. There is thus a selection of the best lands for the planting of cotton, and a correspondingly high yield in Baldwin, Washington, and Escambia, with the additional circumstance that in Washington there are fine lime-hills and shell prairies, with the highly productive river bottoms, which lie adjacent to the same, to bring up its average.

Covington and Geneva, in their very small percentage of blacks (only one in seven or eight), show that their low product per acre must be due to the original poverty of the soil, and the open piny woods which make so large a proportion of these counties would lead us to expect none but soils of much less than average fertility.

The position of Alabama as a state, next to the lowest in product per acre of the fourteen cotton-producing states, has already been justly explained by Dr. Hilgard as due to the exhaustion of the soils by bad or improvident culture, and to the fact that the system of returns to the soil is not yet in general practice, as is shown by the very limited use made of fertilizers. The conditions of the different regions as above set forth furnish ample illustration of the truth of this conclusion.

INFERENCES TO BE DRAWN FROM THESE COMPARISONS.—To recapitulate, the following conclusions seem, therefore, to be plainly taught by the discussion of the data contained in the tables presented on page 60:

1. That where the blacks are in excess of the whites there are the originally most fertile lands of the state. The natural advantages of the soils are, however, more than counterbalanced by the bad system prevailing in such sections, viz, large farms rented out in patches to laborers who are too poor and too much in debt to merchants to have any interest in keeping up the fertility of the soil, or rather the ability to keep it up, with the natural consequence of its rapid exhaustion and a product per acre on these, the best lands of the state, lower than that which is realized from the very poorest.

2. Where the two races are in nearly equal proportions, or where the whites are in only slight excess over the blacks, as is the case in all the sections where the soils are of average fertility, there is found the system of small farms, worked generally by the owners, a consequently better cultivation, a more general use of commercial fertilizers, a correspondingly high product per acre, and a partial maintenance of the fertility of the soils.

3. Where the whites are greatly in excess of the blacks (three to one and above), the soils are almost certain to be far below the average in fertility, and the product per acre is low from this cause, notwithstanding the redeeming influences of a comparatively rational system of cultivation.

4. The exceptions to these general rules are nearly always due to local causes, which are not far to seek, and which afford generally a satisfactory explanation of the discrepancies.

FERTILIZERS.

THE USE OF FERTILIZERS IN COTTON PLANTING IN ALABAMA.—In the foregoing remarks on cotton culture incidental mention has been made of the use (or, to speak more correctly, of the non-use) of commercial fertilizers, from which it may be inferred that systematic efforts at the maintenance of the fertility of the soils in Alabama are not generally made by the farmers. There is, however, probably not a farm in the state where the barnyard manure and composts produced on the farm are not spread upon the land. This kind of manuring is almost universally practiced, but in this way only a very small proportion of the land receives any assistance. In many sections cotton-seed, either alone or composted with other things, and in certain cases also the cottonseed-meal, are beginning to be somewhat generally used, but always as yet sparingly, and upon a small portion only of the whole area in cultivation. In the regions of small farms, and especially where the soils are originally not very strong, the use of commercial fertilizers, guanos, superphosphates, etc., is gradually extending, and more rapidly in the eastern than in the western half of the state. There are many soils until recently thought to be too unproductive for cotton planting which are now quite extensively used for this purpose, since it has been found that, with the use of small quantities of commercial fertilizers, better returns of cotton are realized from such soils than from better soils without the fertilizers. Instances of this are seen in the gray flinty lands of the Coosa valley, the sandy lands of the Coal Measures, and the Barrens of the Tennessee valley.

In the southern counties of the oak, hickory, and long-leaf pine uplands, and in the long-leaf pine region itself, the poor quality of the soils has compelled the farmers to use some means of bringing up the yield, so that the

cultivation of cotton may be at all profitable, and in the eastern half of this region, south of the main central cotton belt, there is probably more sale of the various brands of commercial fertilizers than in any other part of the state of equal area. A central distributing station for much of this southern country is Troy, in Pike county, and it is a matter of common observation that very few of the wagons which haul the cotton to that market return without a load of guano or some other fertilizer. In the Coosa valley region also these brands of commercial fertilizers are now being generally sold in small quantities to farmers. In the Tennessee valley, except on the poorer soils, such as the Barrens, very little besides stable manure or cotton-seed is as yet used as manure. In the great central cotton belt the same remark will apply, only here the manuring is even less generally practiced than in the Tennessee valley. In no instance, except perhaps in some parts of the southern counties above mentioned, is anything more than a very small proportion of the land thus enriched.

It may be said, in general terms, that in the great cotton-producing areas of Alabama the use of commercial fertilizers in cotton planting is comparatively unknown. In the regions of moderate production the system of returns to the soil is more generally practiced, and the use of commercial fertilizers is gradually extending from east to west, being at its best, however, even in these regions, far short of the universal practice. In the regions of very small production these fertilizers are also very seldom in use, the high yield frequently observed in some sections being generally due to the fact that the best soils only are selected for cotton, or that the patches are small enough to be fertilized by the compost produced upon the farm.

FERTILIZERS NATURALLY OCCURRING IN ALABAMA.—As to the necessity of using some means for maintaining the fertility of soils there can now be no two opinions, and exhaustion is, of course, only a matter of time in the case of any soil which is continuously cultivated without restoring to it in some way a portion at least of the plant-food abstracted by the crops produced upon it. It becomes, therefore, a matter of the greatest importance to know what are the resources of the state for keeping up this fertility.

The two classes of manures generally distinguished are *stimulant* and *nutritive*. To the first class belong those substances which, like lime, serve chiefly to render available the plant-food already present in the soil, but in such a condition as to be not readily assimilated by the growing crop. To the second class belong those mixtures which contain some or all of the elements of plant-food, chief among which are nitrogen, potash, and phosphoric acid.

Stimulant manures.—In nearly all parts of Alabama limestone is easily accessible, from which lime for agricultural purposes may be prepared in sufficient quantity. The use of a merely stimulant manure does not keep up the soil fertility, but on the contrary enables crops to draw heavily upon its reserve of plant food, and thus causes its available portion to be exhausted all the more speedily. Lime is also extensively used to promote the rapid decay of vegetable matter, to convert it into humus, and in this way also it is beneficial to soils. The presence of lime in soils has further the effect of increasing their capacity for resisting drought and improving their tilling qualities generally. In addition to all these, it is directly necessary to the growth of all plants. It is chiefly, however, as a stimulant and as a promoter of the formation of humus from vegetable matter that it finds an extended use in agriculture.

Nutritive manures.—Of the partial manures belonging to this class the most extensively used are the guanos, superphosphates, and ground bones, the principal ingredients furnished by these being potash, phosphoric acid, and ammonia. Cotton-seed or cottonseed-meal is also rapidly coming into use as a fertilizer, and it is one of the best, since it contains all of the essential ingredients of plant-food, and may therefore be considered as more nearly a complete manure than any of the others mentioned. In the marls of the state, however, we have a class of fertilizers which combine the qualities of a stimulant with those of a nutritive manure, and they are therefore worthy of careful attention. These marls are found in the Cretaceous and Tertiary strata of the southern division of the state, and are of several varieties. In all the marls there is a certain proportion of nutritive matter in addition to the lime.

Cretaceous marls.—Materials which might profitably be used as fertilizers occur in all three of the subdivisions of the Cretaceous formation in Alabama.

In the lowermost, or Eutaw group of this formation, the deposits are mostly sandy and clayey and non-calcareous, except in the upper strata, which correspond to the Tombigbee sand of Mississippi.

These beds consist of laminated clays and micaceous sands, the latter often of a greenish color, and contain only a small percentage of lime. A specimen of this material from the Turkey Creek hills, near Pleasant Ridge, in Greene county, has the composition given on page 66.

The rotten limestone is itself in composition a marl containing from 20 to 85 per cent. of carbonate of lime, which is the constituent upon which its chief value as a stimulant manure rests; but in addition to the carbonate of lime this rock contains also a variable percentage of phosphate of lime, ranging, according to Dr. Mallett's analyses, between 0.37 and 0.54 per cent.; of potash, from 0.04 to 0.11 per cent.; and of silica in a condition readily soluble in dilute acids, from 0.06 to 0.19 per cent. Several analyses of the rotten limestone from different parts of the state are to be found in Professor Tuomey's second report.

Some of the strata of the rotten limestone contain notable quantities of greensand, and well deserve the attention of farmers. According to Dr. Loughridge, there is a bed of Cretaceous greensand marl extending along the Chattahoochee river bluff for 15 miles with an average thickness of 10 or 15 feet. It contains about 2 per cent. of potash, and would undoubtedly be valuable to the farmers in reach of it.

Near Epes station, in Sumter county, there is another greensand marl bed, and a sample was analyzed with the result given below.

No. 132. *Greenish sand*, Pleasant Ridge, Greene county. This consists of grains of quartz sand, often coated with a green material, scales of mica, rounded and flattened lumps of greensand, and fragments of lignite. The greensand makes only a small proportion of the whole mass, and the marl would hardly pay for the hauling; but its effects upon the soils, over which it is distributed by natural causes, are seen in the luxurious vegetation of the lands which receive the washings of these hills. In other localities it is quite probable that a richer material may be found.

No. 145. *Greensand marl* (Cretaceous), Epes, Sumter county.

Greenish sand and greensand marl (Cretaceous).

	GREENE COUNTY.	SUMTER COUNTY.
	Greenish sand.	Greensand marl.
	No. 132.	No. 145.
Insoluble matter	76.734 } 77.896	57.617 } 59.395
Soluble silica	1.162 }	1.778 }
Potash	0.398	1.439
Soda	0.115	0.118
Lime	0.899	8.922
Magnesia	0.592	0.193
Brown oxide of manganese	0.170	0.101
Peroxide of iron	8.457	13.988
Alumina	0.091	2.161
Phosphoric acid	0.051	0.143
Sulphuric acid	0.789	0.160
Carbonic acid	.....	10.628
Water and organic matter	10.216	2.260
Total	99.674	99.508

The marl, while it contains less lime than the ordinary rotten limestone, is likely to prove valuable as a fertilizer because of its high percentage of potash.

Dr. Mallet tested a sample of greensand from near Gainesville, and found in it: Potash, 2.437 per cent.; phosphoric acid, 0.183 per cent.; and carbonate of lime, 0.87 per cent.

The upper or Ripley group of the Cretaceous is in part composed of bluish micaceous marls containing greensand. In the region of their occurrence these marls give rise to lasting and productive soils, well known in the low grounds of Cowikee and Bear creeks in Barbour and Russell counties.

Dr. Mallet has made several partial analyses of this class of marls, of which the following, a bluish or greenish-gray marl, containing grains of sand, particles of mica, and fragments of shell, from below Eufaula, may be taken as a representative:

	Marl.	Limestone.
Carbonate of lime	13.47	88.82
Carbonate of magnesia	1.01	2.18
Peroxide of iron	3.21	.....
Alumina	1.08	0.94
Phosphoric acid	0.18	0.23
Silicic acid (soluble in acid)	0.54	.....
Insoluble matter (finely divided clay, sand, and specks of mica)	79.14	7.20
	98.63	99.37

In the same formation there are beds of hard and tolerably pure limestone, which might be used in the preparation of lime for agricultural purposes. One of the samples analyzed by Dr. Mallet (see above) from Chunnenugga ridge, Macon county, was a highly fossiliferous limestone, the shells for the most part white crystalline carbonate of lime, and the limestone cementing them together of a light brownish-gray color, containing numerous small cavities, often lined with carbonate of lime. This is the character of much of the limestone of the Chunnenugga ridge.

Tertiary marls.—A special examination was made by me, for the purposes of this report, of the marls and other mineral fertilizers of the Tertiary formations of Alabama. These materials may be conveniently arranged in two classes, viz: I, the greensands, and, II, the calcareous marls; and the latter into those which contain greensand and those whose value depends chiefly upon their content of lime.

I. *The greensands.*—The lower 300 or 400 feet of the Tertiary formation in Alabama are made up, in the main, of sands and clays of lignitic character, but interstratified with these, at several horizons, are beds of marine origin. One of the lowermost of these marine deposits may be seen outcropping at Nanafalia landing, on the Tombigbee river, and may be traced across the country to the Alabama river at Coal bluff, and thence eastward through part of Wilcox county, and perhaps further. One of the strata of this group consists of a mixture of quartz grains, small rounded or flattened lumps of greensand, and a few small particles of mica. The thickness of the deposit is only a foot or two; the color, deep yellowish-green. This greensand bed is best exposed where the Linden and Nanafalia road crosses Double creek in Marengo county. The analysis on page 69 shows the composition of a sample (No. 128) selected from this locality.

Apparently the same bed is exposed on Gravel creek near Camden, Wilcox county, two specimens of which were partially analyzed by Dr. Mallett, yielding in 100 parts:

	No. 1.	No. 2.
	Per cent.	*Per cent.*
Potash	2.21	1.89
Lime	0.69	0.67
Phosphoric acid	Trace.	Trace.
Iron pyrites	Trace.	None.

II. *Calcareous marls: Greensand marls.*—Associated with the bed of greensand above described are several calcareous beds which also hold notable quantities of the same mineral. At Nanafalia landing the upper part of the bluff is formed of 6 feet or more of a shell bed very rich in greensand, which is overlaid by a stratum from 8 to 10 feet thick, composed almost entirely of the shells of a small oyster (*Gryphæa Thyrsa*).

The greensand bed is a mixture of grains of quartz sand, small rounded lumps of greensand, and fragments of shells, together with a large number of perfect and unbroken shells. A sample selected for analysis (No. 127) has the composition given on page 69.

These calcareous beds may be traced across Marengo county by the prairie soils to which they give rise, and are exposed again at Coal bluff, on the Alabama river. A sample from this locality, partially analyzed by Dr. Mallett, consisted of greensand grains, siliceous clay, fine quartz sand, fragments of shells, etc., and had the following composition:

	Per cent.
Potash	1.67
Phosphoric acid	1.00
Carbonate of lime	29.33
Iron pyrites	10.57

Dr. Mallett analyzed also some of the separate grains of greensand of this deposit, the mean of two analyses of which was—

	Per cent.
Silica	57.56
Alumina	6.56
Ferrous oxide	20.13
Lime	1.04
Magnesia	1.70
Potash	4.88
Water	8.17
Total	100.04

The value of marls of this kind depends not only on the carbonate of lime which they contain, but also upon the potash of the greensand, and are therefore the more valuable in proportion to their percentages of greensand, and this proportion may be approximately estimated by the color, the deeper the green the better.

There can hardly be a doubt that these beds will some day be utilized, as they contain a higher average of potash than any of the Tertiary greensand marls thus far examined.

The most convenient localities for getting at the marl for shipment are the Nanafalia landing, on the Tombigbee, and Coal bluff, on the Alabama river. At Turner's ferry, on the Tombigbee, above Tuscahoma, there is exposed a second-marine deposit, containing shells and greensand, but no special examination has been made of it.

Farther down the river, in the vicinity of Wood's bluff, a third exposure of these marine deposits is seen. The marl beds at this place are about 25 feet in thickness, and their geological position is some 175 or 200 feet below the series of aluminous sandstones and claystones to which the name buhrstone has been applied. The strata intervening between the buhrstone rocks and the top of the marl bed are laminated lignitic clays and sands, with a few thin seams of lignite; below the marl, again lignitic beds.

The marl at Wood's bluff is not of uniform composition, the lower strata being much richer both in calcareous matter and in greensand. The upper part of the marl is commonly indurated, forming a kind of limestone, below which the soft pulverulent marl is sometimes sheltered and sometimes washed out, leaving overhanging ledges and caves. This bed, with practically identical features, has been traced from the vicinity of Butler, in Choctaw county, through Choctaw Corner, in Clarke county, to the Alabama river below Lower Peach Tree. The beds occurring at Elba, in Coffee county, are probably the same also, though their identity has not been perfectly established.

Two samples of this marl were analyzed, the one from Mr. Hendrick's, near Butler, the same bed appearing in very many localities about that town, the other from the "Natural Bridge", a few miles west of Choctaw Corner. The specimens analyzed consist of a mixture of broken-up shells, quartz sand, and grains of greensand. In this matrix are imbedded many beautifully preserved entire shells.

No. 126. *Greensand shell marl* from Hendrick's, near Butler, Choctaw county.

No. 130. *Greensand shell marl* from the "Natural Bridge", 2 miles west of Choctaw Corner, Clarke county.

These, like all the greensand marls, owe their peculiar value to the greensand which they contain; hence the more pronounced the green color the better the marl. The 25 to 30 per cent. of carbonate of lime which they all hold is also, of course, of value.

Where these marl beds outcrop across the country they react upon the laminated lignitic clays with which they are interbedded, giving rise to a series of lime-hills of considerable fertility. For an analysis of this class of soil consult lime-hills soil, No. 140, Wilcox county (page 42).

The fourth outcropping of a marl bed down the river from Wood's bluff is seen at Coffeeville landing and vicinity. From its geographical position this seems to be geologically above the buhr-stone rocks, and consists of several beds, chiefly fossiliferous clayey sands and pulverulent and indurated marls.

A sample (No. 138) taken from a loose pulverulent bed just below a hard ledge of similar composition is composed of quartz sand, comminuted shells, a small proportion of greensand grains, and an occasional particle of mica. Its composition is given in the table on page 69. Like the others, this marl, aside from its carbonate of lime, owes its value to its content of greensand.

The lower portion of the bluff at Claiborne, on the Alabama river, consists of sandy, argillaceous, and calcareous beds, the latter containing many oyster shells. A sample from one of these beds, about 15 feet above the water level (No. 136), was composed of quartz grains, pulverulent carbonate of lime, clayey matter, and a few grains of greensand. Its chemical composition is given on page 69. From the similarity in the fossils (which have not, however, been very closely studied) it appears probable that the Coffeeville marl bed is identical with some of the lower strata of the Claiborne bluff.

Ordinary calcareous marls, white marls.—At the Claiborne bluff the stratum, 15 to 20 feet in thickness, which has furnished all the beautifully preserved fossils which have made this locality so celebrated is a mass of comminuted shells and quartz sands stained with iron. In this material the Claiborne fossils are imbedded. A sample of this marl from Mrs. Gibson's, a short distance below Claiborne, was analyzed. Its composition is given on page 69 under No. 135, Claiborne shell marl from Mrs. Gibson's, near Claiborne. The value of this marl rests mainly upon its carbonate of lime. With from 47 to 50 per cent. of inert siliceous matter, it would hardly be profitable to carry it far, but it might be used with advantage in the vicinity.

This shell stratum is one of the topmost of the Claiborne group proper. Immediately above it are laminated gray clays and fossiliferous yellowish sands containing greensand, and above these a thick bed of whitish, soft limestone, containing occasionally a few grains of greensand. This limestone is considered as belonging to the Jackson group of the Tertiary, and in its disintegration gives rise to the prairie soils of the lower lime-hills region, and is in many respects similar to the Cretaceous rotten limestone. Its composition may be seen from the subjoined analysis of soft, white limestone (No. 137) overlying the shell stratum at Claiborne (Jackson age).

This, like the rotten limestone, is itself of the nature of a marl, and its action upon the soil is well shown in the prairie soils of the lime-hills.

In very many of the localities where this limestone occurs crystals and large masses of gypsum are imbedded in the clays which result from its disintegration, and sometimes in such quantity that it might be profitably taken up for agricultural purposes. Nothing has, however, yet been done in this direction. The unusually high percentage of sulphuric acid in the limestone, as well as in many of its derived soils, is probably due to the gypsum.

The uppermost division of the Tertiary in Alabama, the so-called Vicksburg group, is made up chiefly of white or light-colored limestones and marls, the most common rock being a soft, white limestone, containing orbitoides and other characteristic fossils. A sample of this rock from Clarke county, above Jackson (No. 146), has been analyzed, and its composition is given in the table relative to Tertiary marls.

This, as will be seen, is a tolerably pure limestone, and when burned would give a large yield of lime. Its potash and phosphoric acid also are rather above the average.

To recapitulate: The mineral fertilizers of the Alabama Tertiary formations are greensands, greensand marls, and white marls and limestones, which occur at the following horizons, viz:

1. Greensand and greensand marls at Nanafalia landing and across the country to Coal bluff, on the Alabama river, and on Gravel creek, in Wilcox county. These beds appear to be the richest in greensand.

2. A marl bed at Turner's ferry, above Tuscahoma, on the Tombigbee.

3. The greensand marls at Wood's bluff; found also near Butler, in Choctaw county, and across Clarke county, to the Alabama river, below Lower Peach Tree.

4. Greensand marls at Coffeeville and at Claiborne, and, at the latter place, also near the top of the bluff, the shell marl.

5. Overlying the Claiborne shell beds, the marly or argillaceous limestone of Jackson age, which is known by its outcrops and by the peculiar soils resulting from it, from the western limit of the state, through Washington and Clarke, into Monroe and Conecuh, and thence in detached tracts to southeastern Alabama.

6. The white marls and limestones of the Vicksburg group, occurring in all the localities mentioned in the preceding paragraph, but much more widely distributed.

Most of the localities above given are in western Alabama. The Tertiary formations in the eastern part of the state are more generally calcareous and less intermingled with lignitic strata than is the case westward, and they appear also to be more generally hidden by the superficial drift deposits.

Marls and limestones are exposed on the Chattahoochee river at intervals from below Eufaula down to the Florida line, but I am at present unable to give any details concerning them.

Analyses of Tertiary marls.

	GREENSAND.	GREENSAND SHELL MARLS.					ORDINARY MARLS.		
	MARENGO COUNTY.	MARENGO COUNTY.	CHOCTAW COUNTY.	CLARKE COUNTY.		MONROE COUNTY.	MONROE COUNTY.	CLEBURNE COUNTY.	CLARKE COUNTY.
	Greensand.	Greensand shell marl.	Hendrick's, near Butler.	Near Choctaw Corner.	Greensand shell marl.	Marl, with greensand.	Claiborne shell marl.	Soft, white limestone.	White lime stone.
	No. 128.	No. 127.	No. 126.	No. 130.	No. 138.	No. 136.	No. 135.	No. 137.	No. 146.
Insoluble matter	78.712	35.918	65.005	62.329	63.153	60.434	45.877	28.394	
Soluble silica	1.195 } 79.907	1.363 } 37.281	2.833 } 67.838	2.115 } 64.444	1.153 } 64.306	1.876 } 62.310	1.981 } 47.858	2.920 } 31.314	2.542
Potash	0.635	2.254	1.026	0.457	0.372	0.633	0.331	0.502	0.347
Soda	0.087	0.346	0.085	0.252	0.259	0.222	0.498	0.077	0.132
Lime	0.859	24.164	13.757	16.866	14.491	15.390	26.514	34.952	47.779
Magnesia	0.284	1.617	0.616	0.795	0.594	0.856	0.665	0.743	0.602
Brown oxide of manganese	0.011	0.079	0.029	Trace.	0.089	0.321	Trace.	0.156	0.653
Peroxide of iron	9.192	12.324	4.286	2.083	2.149	3.867	2.332	1.798	3.123
Alumina	1.103	0.930	0.083	0.139	1.883	1.355	0.769	1.159	
Phosphoric acid	0.086	0.041	0.161	0.223	0.040	0.125	0.029	0.096	0.305
Sulphuric acid	0.051	0.310	0.106	0.054	0.164	0.117	0.070	0.290	0.623
Carbonic acid	Traces.	18.986	10.983	14.154	12.359	11.805	20.552	27.471	39.000
Water and organic matter	5.713	0.728	1.393	1.366	3.102	2.832	1.554	2.207	4.162
Total	97.928	99.060	100.363	100.743	99.808	99.833	100.572	100.765	99.268

Of other naturally occurring materials which have been profitably used, either in compost heaps or directly upon the lands, there may be mentioned pond or marsh muck, which is specially rich in humus and also in certain mineral elements of plant-food. This substance is generally accessible in the state, and should, whenever practicable, be used in connection with the marls mentioned.

Professor Hilgard long since called attention to the value of the straw of the long-leaf pine as a manure, and his analyses show that it contains in considerable quantities the mineral ingredients necessary to plants. According to the same authority, the best manner of applying it, next to incorporating it with the manure pile, is to compost the manure with lime or some of the calcareous marls of which mention has been made, and, after it has become thoroughly decayed, then to spread it upon the land.

The following analysis of a specimen of muck from a swamp near the banks of Autauga creek, at Prattville, Autauga county, will show the general nature of this material. The swamp has a dense growth of magnolia, bay, laurel, short-leaf pine, sweet gum, sassafras, maple, elder, button-ball, white oak, swamp oak, dogwood, buckeye, *Rhus vernix*, etc. When cleared and drained such swamps are at first liable to suffer the drawbacks incident to an excess of humus, but after being a while in cultivation, and sand and loam become mixed with the humus, very productive soils result.

No. 2. *Black swamp muck* from the bottom of Autauga creek, at Prattville, Autauga county. A light-black pulverulent mass when dry.

Swamp muck, Autauga county.

	No. 2.
Insoluble matter	51.078
Soluble silica	
Potash	0.487
Soda	0.265
Lime	0.472
Magnesia	0.007
Brown oxide of manganese	Trace.
Peroxide of iron	Trace.
Alumina	1.362
Phosphoric acid	0.060
Sulphuric acid	0.296
Water and organic matter	44.574
Total	99.201
Hygroscopic moisture	18.47
absorbed at	20.5 C.°

The hygroscopic character of the humus is here well exhibited. The material contains a comparatively large percentage of lime and potash, but the phosphoric acid is rather deficient. This muck would improve the physical characters both of light sandy and of heavy clayey soils.

Table of analyses of Alabama soils and subsoils.

Number.	Name.	Locality.	County.	Depth in inches.	Vegetation.	Insoluble residue.	Soluble silica.	Potash.	Soda.	Lime.	Magnesia.	Brown oxide of manganese.	Ferric oxide.	Alumina.	Phosphoric acid.	Sulphuric acid.	Carbonic acid.	Volatile matter.	Total.	Hygroscopic moisture.	Temperature of absorption (C.°).	Analyst.
	METAMORPHIC REGION.																					
78	Red lands soil	6 miles north of Opelika.	Lee	10	Red, Spanish, and post oaks, and some short-leaf pine.	68.710	3.830	0.350	0.119	0.043	0.050	0.100	10.740	9.237	0.170	0.080	.....	7.011	100.440	7.396	27.8	John B. Durrett.
79	Gray lands soils	.....do	....do	8	.....do	79.170	3.256	0.268	0.067	0.167	0.130	0.093	3.144	5.120	0.229	0.043	.....	7.742	99.429	4.535	26.7	Do.
107	Mica slate soil (graphitic).	4 miles north of Roanoke.	Randolph	8	Post, black, red, and black-jack oaks; some pine and hickory.	77.354	3.986	0.536	0.086	0.010	0.145	0.146	6.861	5.693	0.067	0.057	.....	4.772	99.713	4.612	7.2	Henry McCalley.
103	Mica slate soil (garnetiferous).	S. 27, T. 19, R. 7 E.	Clay	4	Black, post, red, and Spanish oaks; a few chestnuts.	66.174	9.263	0.351	0.246	0.038	0.155	0.151	9.303	8.083	0.137	0.090	.....	5.706	99.697	5.910	6.1	Do.
	COOSA VALLEY REGION.																					
70	Flatwoods soil	3 miles northeast of Ashville.	Saint Clair	10	Post oaks, short-leaf pine, and hickory.	70.650	8.933	0.277	0.078	0.159	0.478	0.079	6.528	7.497	0.075	0.013	.....	4.777	99.544	11.150	27.2	Chappell Cory.
71	Red valley soil	1½ miles south of Jacksonville.	Calhoun	12	Red, Spanish, and post oaks, hickory, and short-leaf pine.	80.520	3.941	0.290	0.062	0.112	0.260	0.057	5.011	5.722	0.126	0.056	.....	4.501	100.658	8.063	26.7	John B. Durrett.
76	.....do	Near Mrs. Walker Reynolds.	Talladega	12	Red, white, Spanish, and post oaks, sweet and sour gums, and hickory.	64.070	7.647	0.339	0.111	0.091	0.143	0.137	7.157	11.229	0.176	0.010	.....	*8.298	99.408	19.400	24.4	Do.
45½	Red upland soil	Near Pratt's ferry	Bibb	6–12	White, black, and post oaks, walnut, hickory, chestnut, mulberry, cedar, dogwood, and black gum.	81.480	6.530	0.328	0.027	0.255	0.210	0.189	2.016	5.614	0.110	0.167	.....	3.587	100.513	4.528	28.3	Chappell Cory.
67	Little Cahaba valley soil.	6 miles southwest of Springville.	Saint Clair	12	Red, black, and Spanish oaks, hickory, chestnut, and sweet gum.	73.433	7.459	0.240	0.041	0.225	0.476	0.241	5.518	7.498	0.165	0.007	.....	4.719	100.022	9.525	7.2	Henry McCalley.
69	Gray upland cherty soil.	1 mile north of Ashville.	....do	10	Red and Spanish oaks, liriodendron, hickory, dogwood, and short-leaf pine.	83.440	4.230	0.109	0.018	0.202	0.181	0.042	2.178	4.521	0.093	0.048	.....	5.301	100.363	8.528	26.7	Chappell Cory.
123	Sandy brown-loam soil.	3 miles west of Birmingham.	Jefferson	10	Red and willow oaks, sassafras, and grape-vines.	85.990	4.341	0.176	0.028	0.152	0.116	0.041	2.840	3.188	0.066	0.051	.....	2.522	99.511	7.835	24.4	Henry McCalley.
68	Red mountain soil	3 miles north of Springville.	Saint Clair	10	Large liriodendron, white oak, and chestnut.	81.560	3.680	0.206	0.037	0.363	0.279	0.214	4.918	3.539	0.168	0.083	.....	4.830	99.877	9.799	27.2	Chappell Cory.
111	Red lands soil	Dry valley n'r Gaylesville.	Cherokee	8	Red, post, white, and Spanish oaks, hickory, persimmon, chestnut, black gum, sourwood, and dogwood.	78.725	6.042	0.261	0.124	0.330	0.395	0.215	3.707	5.077	0.089	0.097	.....	*5.150	100.212	4.500	26.7	John B. Durrett.
	COAL-MEASURES REGION.																					
110	Upland soil	Sand mountain near Valley Head.	De Kalb	10–20	Chiefly red oak, some black oak, hickory, dogwood, and chestnut.	86.350	4.352	0.230	0.141	0.068	0.154	0.070	1.443	6.324	0.073	0.062	.....	0.844	100.111	3.368	16.1	Henry McCalley.
	TENNESSEE VALLEY REGION.																					
40	Barrens soil	Near Cluttsville	Madison	8	Post, black, red, Spanish, and black-jack oaks, scrub hickory, wild gooseberry, blackberry, and huckleberry.	89.950	2.292	0.255	0.064	0.064	0.035	0.150	1.695	3.292	0.100	0.178	.....	2.024	100.099	4.450	21.1	John B. Durrett.
48	.....do	Near Huntsville	....do	6	Scrubby post and black oaks, dogwood, and some hickory.	84.160	4.560	0.116	0.025	0.041	0.159	0.041	2.705	4.597	0.054	0.045	.....	3.388	99.891	4.785	28.3	Chappell Cory.
52	Gravelly soil	Limestone creek bottom.	....do	.....	Poplar, beech, sugar maple, sycamore, gum, walnut, red, white, and black oaks.	79.005	6.023	0.270	0.161	0.182	0.224	0.239	2.871	4.834	0.209	0.010	.....	*5.758	99.786	6.881	9.4	Henry McCalley.
56	Gravelly river hills soil.	Tennessee river near Tuscumbia.	Colbert	4½	Red, white, and black-jack oaks, dogwood, white poplar, and scrub walnut.	79.320	6.760	0.309	0.067	0.398	0.226	0.324	2.969	4.771	0.153	0.172	.....	4.458	99.927	5.371	28.3	Chappell Cory.
38	Red lands soil	Near Cluttsville	Madison	11	Hickory, poplar, ash, chestnut, walnut, black, red, and white oaks, elm, cedar, black haw, and dogwood.	77.950	5.343	0.243	0.058	0.648	0.058	0.103	2.873	6.198	0.188	0.025	.....	*6.620	100.307	9.760	21.1	John B. Durrett.
34	.....do	1 mile east of Tuscumbia.	Colbert	10	Black-jack, post, and red oaks, hickory, and some cedar.	76.023	8.995	0.276	0.133	0.267	0.381	0.218	5.230	5.691	0.151	0.020	.....	*1.794	99.179	8.840	7.8	Henry McCalley.

* See table of humus determinations.

Table of analyses of Alabama soils and subsoils—Continued.

Number.	Name.	Locality.	County.	Depth in inches.	Vegetation.	Insoluble residue.	Soluble silica.	Potash.	Soda.	Lime.	Magnesia.	Brown oxide of manganese.	Ferric oxide.	Alumina.	Phosphoric acid.	Sulphuric acid.	Carbonic acid.	Volatile matter.	Total.	Hygroscopic moisture.	Temperature of absorption (C.°).	Analyst.
	TENNESSEE VALLEY REGION—continued.																					
64	Red lands soil	Near Russellville, in Russell's valley.	Franklin	15	Red, black, white, post, and black-jack oaks, cedar, dogwood, chestnut, black walnut, cherry, and black locust.	75.360	5.237	0.154	0.110	0.250	0.250	0.138	5.623	8.163	0.229	0.039	.....	4.100	99.653	6.140	26.7	John B. Durrett.
36	Sandy loam soil	Little mountain, near Tuscumbia.	Colbert	8	Chestnut, short-leaf pine, hickory, post oak, small sourwood, wild pinks, and phlox.	93.630	1.682	0.100	0.060	0.120	0.040	0.102	0.761	1.532	0.051	0.028	.....	2.055	100.161	1.560	25.6	Do.
	GRAVELLY PINE-HILLS REGION.																					
6	Upland sandy loam	4 miles east of Prattville.	Autauga	8	Short-leaf pine, red and post oaks, hickory, dogwood, black gum, chestnut, persimmon, and mulberry.	89.100	2.840	0.073	0.018	0.060	0.061	0.122	1.577	4.350	0.077	0.034	.....	2.206	100.518	3.882	16.1	Chappell Cory.
57	Brown-loam soil	Near Mulberry	do	.....	White, post, and red oaks, hickory, dogwood, black gum, and some pine.	91.510	1.960	0.115	0.004	0.057	0.140	0.027	1.527	0.943	0.042	0.013	.....	2.888	99.226	2.905	28.3	Do.
60	Brown loam subsoil of No. 57.	do	do	6–12	do	84.520	4.620	0.136	0.010	0.109	0.172	0.071	2.422	6.078	0.078	0.074	.....	2.477	100.767	5.390	28.9	Do.
3	Upland pine woods soil.	Near Prattville	do	8	Long-leaf pine, hickory, red, post, and black-jack oaks; black gum.	94.170	1.390	0.040	0.006	0.069	0.052	0.117	0.744	0.603	0.062	0.009	.....	2.807	100.069	1.916	23.9	Do.
4	Upland pine woods subsoil of No. 3.	do	do	12–18	Dogwood, persimmon, muscadine, buckeye, and sassafras.	88.860	3.380	0.111	0.029	0.047	0.139	0.125	1.572	4.320	0.977	0.002	.....	1.660	100.322	6.079	18.9	Do.
61½	Pond lands soil (exhausted).	Near Mulberry	do	6–12	Sweet gum mostly	78.630	6.045	0.193	0.094	0.019	0.198	0.079	0.810	7.951	0.076	0.132	.....	6.101	100.328	7.697	27.8	Do.
9	Alabama river hummock soil.	4 miles west of Montgomery.	do	8	Red and white oaks, poplar, beech, sweet gum, elm, hickory, cherry, walnut, mulberry, sourwood, dogwood, thorny ash, grapes, and muscadines.	77.080	6.067	0.335	0.189	0.136	0.303	0.384	5.357	4.841	0.137	0.040	.....	*5.230	100.069	8.198	17.2	Henry McCalley.
20	Warrior river hummock soil.	Near Tuscaloosa	Tuscaloosa	6	Dense cane thicket	73.995	6.518	0.252	0.052	0.468	0.429	0.006	4.395	5.182	0.274	0.071	.....	*8.893	100.535	18.811	17.2	R. H. Loughridge.
66	do	do	do	14	Originally cane; now sweet gum and red oak.	69.900	10.987	0.448	0.033	0.343	0.547	0.190	5.303	6.004	0.325	0.078	.....	6.311	100.463	8.707	29.4	Do.
21	Warrior river hummock soil (cultivated 20 years).	do	do	14	Dense cane thicket	73.339	8.777	0.383	0.052	0.314	0.502	0.041	4.590	5.288	0.214	0.072	.....	6.617	100.189	15.836	20.0	Do.
22	Subsoil of Nos. 20, 21, and 66.	do	do	14–24	do	71.227	10.665	0.504	0.196	0.241	0.516	0.081	10.254	2.105	0.284	0.034	.....	4.490	100.597	14.016	16.7	Do.
	OAK, HICKORY, AND LONG-LEAF PINE UPLANDS.																					
140	Lime-hills soil	10 miles west of Lower Peach Tree.	Wilcox	8	Mostly beech, some hickory, short-leaf pine, oaks, ash, poplar, sweet and sour gum, holly, etc.	75.550	1.134	0.174	.....	0.184	0.014	0.032	5.545	7.773	0.229	0.060	.....	8.922	99.616	17.067	10.5	Henry McCalley.
94	Sandy upland soil (cultivated).	Near Clayton	Barbour	1–12	Post oak, black-jack, hickory, dogwood, and short-leaf pine.	95.091	1.913	.....	0.007	0.010	0.056	0.131	0.609	1.386	0.025	0.001	.....	0.443	99.666	0.878	5.6	Do.
84	Upland sandy-loam soil.	Near Lawrenceville	Henry	10	Red, Spanish, and post oaks, black-jack, hickory, chestnut, gum, short-leaf pine, and some long moss.	95.115	1.155	0.212	0.096	0.068	0.039	0.128	0.803	0.703	0.100	0.016	.....	2.009	100.434	1.225	23.3	John B. Durrett.
18	Upland brown-loam soil.	5 miles southeast of Troy.	Pike	8	Red oak; few short-leaf pines	91.965	1.915	0.677	0.013	0.112	0.094	0.044	1.431	1.841	0.109	0.015	.....	2.137	99.753	2.590	19.4	R. H. Loughridge.
19	Upland brown-loam subsoil.	do	do	8–20	do	90.960	2.425	0.150	0.056	0.048	0.080	0.092	1.574	3.197	0.072	0.072	.....	1.532	100.258	2.826	18.3	John B. Durrett.
92	Alabama river second-bottom soil.	Near Lower Peach Tree.	Wilcox	9	Sweet-gum, short-leaf pine, poplar, Spanish, red and white oaks, haw, and hackberry.	86.510	3.269	0.168	0.074	0.221	0.055	0.184	1.783	2.290	0.200	0.073	.....	4.510	99.337	5.916	22.2	Do.

	CENTRAL PRAIRIE REGION.																					
30	Black prairie soil	8 miles northeast of Livingston.	Sumter	10	Post, red, and black-jack oaks, cedar, and prairie white oak.	46.990	17.920	0.444	0.077	1.961	0.603	0.108	6.944	12.415	0.102	0.073		*11.720	99.359	12.330	23.3	Chappell Cory.
33	do	2 miles north of Livingston.	do	10	Post, red, and black-jack oaks, cedar, prairie white oak, walnut, and cane.	81.745	2.346	0.205	0.076	0.960	0.061	0.192	3.343	6.168	0.318	0.152		*4.075	100.141	6.042	26.7	John B. Durrett.
16	do	4 miles from Union Springs.	Bullock	12	Post and black oaks, short-leaf pine, haw, crab-apple, and some red oak.	57.831	10.431	0.288	0.027	0.981	0.802	0.452	7.855	11.488	0.507	0.090		8.036	98.728	14.489	16.7	Henry McCalley.
77	Black prairie slough soil.	8 miles south of Montgomery.	Montgomery	8	Hickory and white oak chiefly	25.188	23.792	0.441	0.119	8.672	1.170	0.173	7.074	15.565	0.201	0.125	5.728	*11.589	99.843	19.902	7.2	Do.
17	Post-oak prairie soil	Near Union Springs	Bullock	12	Post oak, with long moss, hickory, short-leaf pine, and blackjacks.	71.366	11.961	0.209	0.016	0.371	0.290	0.055	6.963	6.022	0.251	0.073		*2.888	100.505	8.574	16.7	Do.
11	Chunnenugga ridge soil.	do	do	6	Chestnut, short-leaf pine, and red oak.	94.770	0.486	0.156	0.069	0.081	0.069	0.156	0.706	0.732	0.101	0.057		2.642	100.026	1.943	13.3	John B. Durrett.
12	Chunnenugga ridge subsoil.	do	do	6–20	do	96.810	1.060	0.165	0.107	0.110	0.035	0.065	0.490	0.867	0.113	0.035		0.550	100.407	0.822	16.7	Do.
13	Upland sandy-loam soil.	2½ miles south of Union Springs.	do	f	Black and some post oaks, short-leaf pine, and huckleberry.	93.890	1.878	0.209	0.134	0.076	0.021	0.065	0.883	1.260	0.058	0.069		2.062	100.619	1.842	13.9	Henry McCalley.
96	Low grounds soil	Cowikee creek	Barbour	8	Red, white, and post oaks, hickory, and short-leaf pine.	73.303	11.592	0.245	0.060	0.280	0.351	0.113	2.668	5.489	0.113	0.013		4.708	98.983	5.544	5.6	Do.
	FLATWOODS REGION.																					
25	Post-oak flatwoods soil	4 miles west of Livingston.	Sumter	10–48	Post oak chiefly, red oak, hickory, and short-leaf pine.	67.020	10.050	0.295	0.125	0.198	0.610	0.115	6.543	10.198	0.212	0.027		5.031	100.424	13.040	23.3	John B. Durrett.
26	Post-oak flatwoods subsoil.	do	do	10–48	do	79.662	5.031	0.223	0.059	0.359	0.596	0.078	7.711	3.308	0.072	0.026		2.356	99.476	12.841	9.4	Henry McCalley.
98	Post-oak flatwoods clay	6 miles south of Linden	Marengo	10	Post oaks chiefly	72.746	8.926	0.416	0.112	0.080	0.691	0.106	12.406	2.473	0.103	0.061		1.906	100.026	13.941	7.8	Do.
	LIME-HILLS REGION.																					
189	Black-shell prairie soil	R. A. Long, S. 9, T. 8, R. 3 W.	Washington	8	Dogwood, white and black oaks, sweet gum, ash, short-leaf pine, etc.	21.655	1.754	0.553	0.192	29.195	0.489	0.113	5.421	5.155	0.371	0.462	22.277	12.845	100.382	13.560	20.5	Do.
90	Upland brown-loam soil	6 miles north of Gosport.	Clarke	10	Post, red, black, and Spanish oaks, short- and long-leaf pine, and some hickory.	87.753	3.067	0.140	0.010	0.096	0.066	0.050	1.999	3.397	0.120	0.010		3.090	99.808	2.895	23.3	John B. Durrett.
91	Under clay or subsoil of No. 90.	do	do	24–36	do	71.652	5.962	0.350	0.048	0.326	0.091	0.123	7.408	8.606	0.295	0.090		5.187	100.188	14.380	23.2	Do.
89	Murder creek second-bottom soil.	2 miles west of Evergreen.	Conecuh	12	Sweet gum, magnolia, white and water oaks, and short-leaf pine.	89.870	1.592	0.140	0.016	0.094	0.018	0.078	2.385	3.355	0.122	0.005		2.480	100.155	2.653	23.9	Do.
	LONG-LEAF PINE REGION.																					
88	Upland pine-woods soil	13 miles east of Andalusia.	Covington	10	Long-leaf pine, post, Spanish, black-jack, and upland willow oaks, and some hickory.	90.815	1.575	0.170	0.036	0.065	0.032	0.112	1.143	3.018	0.111	0.097		2.772	99.936	2.558	23.3	Do.

* See table of humus determination.

Analyses showing the composition at different depths of the surface beds of loam and drift in the southern division.

115	Brown-loam soil	Near city of Tuscaloosa	Tuscaloosa	5		81.683	0.465	0.255	0.175	0.140	0.097	0.102	4.184	7.061	0.090	0.025		5.425	99.722	6.305	18.0	Daniel W. Langdon, jr.
116	Subsoil of No. 115, deep red.	do	do	5–18		84.777	0.656	0.205	0.175	0.065	0.100	0.099	4.903	6.278	0.086	0.063		2.288	99.715	7.275	18.0	Do.
117	Under subsoil of No. 115, deep red.	do	do	18–42		91.493	0.066	0.150	0.140	0.071	0.005	0.066	2.495	3.466	0.007	0.071		1.987	100.017	5.647	19.0	Do.
118	Red sandy loam (under No. 117).	do	do	42–90		88.989	1.827	0.139	0.135	0.045	0.004	0.061	2.592	3.998	0.007	0.066		1.791	99.654	4.103	18.0	Do.
119	Red sandy loam, becoming yellowish below (under No. 118).	do	do	90–114		96.405	0.687	0.005	0.004	0.006	0.002	0.008	1.910	0.786	0.003	0.004		0.841	100.656	3.996	18.0	Do.
120	Yellowish coarse sand (below No. 119).	do	do	114–168		98.370	0.086	0.005	0.003	0.004	0.001	0.002	0.717	0.454	0.001	0.004		0.752	100.399	0.290	19.0	Do.
122	Gray clay, specked with red.	do	do	Bottom of gully.		81.837	0.256	0.256	0.197	0.341	0.194	0.010	0.576	11.314	0.001	0.159		5.149	100.272			Do.

Table showing humus and available inorganic matter in soils (percentages are referred to soils).

	No. 76.	No. 111.	No. 52.	No. 38.	No. 34.	No. 9.	No. 20.	No. 30.	No. 32.	No. 77.	No. 17.
Humus	0.984	1.365	1.974	2.242	0.700	1.047	2.310	2.330	2.000	2.460	0.718
Available inorganic matter	.....	1.061	0.860	1.551	0.956	0.862	1.255	0.740	1.430	1.874	2.426
Available phosphoric acid	0.020	0.029	0.073	0.109	0.020	0.058	0.112	0.060	0.108	0.037	0.015

Analyses showing composition of greensands, greensand marls, shell marls, and limestones of the Cretaceous and Tertiary formations of Alabama.

Number.	Name.	Locality.	County.	Insoluble residue.	Soluble silica.	Potash.	Soda.	Lime.	Magnesia.	Brown oxide of manganese.	Ferric oxide.	Alumina.	Phosphoric acid.	Sulphuric acid.	Carbonic acid.	Volatile matter.	Total.
132	Greenish micaceous sands (Cretaceous).	Pleasant Ridge	Greene	76.734	1.162	0.398	0.115	0.899	0.592	0.170	8.457	0.091	0.051	0.789	.....	10.216	99.674
145	Greensand marl (Cretaceous).	Epes Station	Sumter	57.617	1.778	1.439	0.118	8.922	0.193	0.101	13.988	2.161	0.143	0.160	10.628	2.260	99.508
128	Greensand (Tertiary).	Double creek	Marengo	78.712	1.195	0.635	0.087	0.859	0.284	0.011	9.192	1.103	0.086	0.051	traces.	5.713	97.928
127	Greensand shell marl (Tertiary).	Nanafalia landing	do	35.918	1.363	2.254	0.346	24.164	1.617	0.079	12.324	0.930	0.041	0.310	18.986	0.728	99.060
126	do	Hendricks, near Butler.	Choctaw	65.005	2.833	1.026	0.085	13.757	0.616	0.029	4.286	0.083	0.161	0.106	10.983	1.393	100.363
130	do	Near Choctaw Corner.	Clarke	62.329	2.115	0.457	0.252	16.866	0.705	trace.	2.083	0.139	0.223	0.054	14.154	1.366	100.743
138	do	Coffeeville landing	do	63.153	1.153	0.372	0.259	14.491	0.594	0.089	2.149	1.883	0.040	0.164	12.359	3.102	99.808
136	Marl, with greensand (Tertiary).	15 feet above water-level at Claiborne.	Monroe	60.434	1.876	0.633	0.222	15.390	0.856	0.321	3.867	1.355	0.125	0.117	11.805	2.832	99.883
135	Claiborne shell stratum (Tertiary).	Mrs. Gibson's, Claiborne.	do	45.877	1.981	0.331	0.498	26.514	0.065	trace.	2.332	0.769	0.029	0.070	20.552	1.554	100.572
137	Soft, white limestone (Tertiary, Jackson).	Overlying shell stratum at Claiborne.	do	28.394	2.920	0.502	0.077	34.952	0.743	0.156	1.798	1.159	0.096	0.290	27.471	2.207	100.765
146	White limestone (Tertiary, Vicksburg).	North of Jackson	Clarke	2.542		0.347	0.132	47.779	0.602	0.653	3.123		0.305	0.623	39.000	4.162	99.268
2	Black swamp muck	Prattville	Autauga	51.678		0.487	0.265	0.472	0.007	trace.	trace.	1.362	0.060	0.296	.....	44.574	*99.001

* Hygroscopic moisture, 18.47; absorbed at 20.5 C.°.

No. 146 was analyzed by T. W. Palmer; all the others by Henry McCalley.

PART II.

AGRICULTURAL DESCRIPTIONS

OF THE

COUNTIES OF ALABAMA.

AGRICULTURAL DESCRIPTIONS

OF THE

COUNTIES OF ALABAMA.

The counties are here grouped under the heads of the several agricultural regions, previously described, to which each predominantly belongs, or, in some cases, under that to which it is popularly assigned. Each county is described as a whole. When its territory is covered in part by several adjacent soil-regions, its name will be found under each of the several regional heads in which it is concerned, with a reference to the one under which it is actually described. In the lists of counties placed at the head of each group the names of those described elsewhere are marked with an asterisk (*), and the reference to the head under which these are described will be found in its place, in the order of the list, in the text itself.

The regional groups of counties are placed in the same order as that in which the regional descriptions themselves are given.

The statements of areas, of woodland, prairie, etc., refer to the original state of things, irrespective of tilled or otherwise improved lands.

Appended to the description of each county from which a report or reports have been received is an abstract of the main points of such reports, so far as they refer to natural features, production, and communication. Those portions of the reports referring to agricultural and commercial practice are (in condensed form) placed in a separate division (Part III), following that of the county descriptions.

In making the abstracts of these reports it has been necessary, in most cases, to change somewhat the language of the reporter while preserving the sense. In some cases statements palpably incorrect or overdrawn have been altogether omitted, while sometimes explanatory words have been added, placed in parentheses.

METAMORPHIC REGION.

The following counties lie partly or wholly within the metamorphic region: Cleburne, Randolph, Chambers, Lee, Tallapoosa, Clay, Coosa, Talladega,* Chilton,* Elmore,* and Macon.*

CLEBURNE.

Population: 10,976.—White, 10,308; colored, 668.

Area: 540 square miles.—Woodland, all. Metamorphic, 400 square miles; Coosa valley, 140 square miles.

Tilled land: 51,428 acres.—Area planted in cotton, 9,156 acres; in corn, 21,552 acres; in oats, 5,672 acres; in wheat, 7,504 acres; in tobacco, 85 acres; in sweet potatoes, 221 acres.

Cotton production: 3,600 bales; average cotton product per acre, 0.39 bale, 555 pounds seed-cotton, or 185 pounds cotton lint.

The northern part of Cleburne county consists of high and rugged mountains of sandstone and subordinated ridges of flint or chert, alternating with valleys or inclosing coves of red or yellow fertile lands. This part of the county is of the same nature as adjoining portions of Cherokee and Calhoun. The red soils are based on the magnesian limestones of the country, and the broken and ridgy lands have a soil of gray or light colors. All these valley lands contain more or less of angular flinty gravel in both soil and subsoil. The timber on the flint ridges is in many cases prevalently long-leaf pine; upon the sandstone mountain the oaks and short-leaf pine predominate as a rule. The mountain lands are generally uncultivated; the ridge lands also, especially where

there is much of the chert or flint in large masses. Upon the slopes, however, there are often very good sorts of gravelly land with yellow subsoil under cultivation. The rest of the county is made up of slaty or crystalline rocks, and the soils derived from them are of two principal classes, viz: the red and the gray lands. In addition to these there are the sandy lands of the creek and river bottoms. In crossing the county from northwest to southeast one goes across the belts of different rocks and of the different classes of soils which are derived from them.

The western boundary of the county, as far north as township 14, is made by a mountain range of crystalline slates and conglomerate. In township 14 this range turns eastward, and its prolongation in Georgia is known as Dug-Down mountain. On this mountain, which is several miles wide, there is very little level land, and as the rocks which form the mountain furnish soils that are sandy and clayey and, in the main, not very fertile this part of the county is comparatively thinly settled and little cultivated. Across the mountain we descend into the valley of the Tallapoosa river, and of Cane creek, its western fork. The width of this valley varies, being at Ross' ford about one mile. The bottom lands are generally best suited to corn and other grain, though some are cultivated in cotton. The valley of the Tallapoosa is separated from that in which Arbacoochee is situated by a ridge some 200 or 250 feet in height, with little level land and few settlements. The valley of Arbacoochee is drained by a small stream called Dying creek, and in this valley many of the characteristic features of the valley lands of this region are well shown. The rocks which underlie these valley lands are comparatively easily disintegrated by the atmospheric agencies, and near the surface they have been weathered into reddish and yellowish clays, which retain the bedding or stratification of the original rocks. These rocks consist in part of thin beds or sheets of quartz, which resist decay, and as the more yielding materials are worn away the quartz fragments cover the ground. The soil is a dark-colored loam, underlaid with a red clay, which is the result of the removal and redeposition of the underlying slates, which, in turn, are the stratified clays resulting from the decay, in place, of the original rocks, as before stated. The valley lands are rolling and gently undulating, and comprise many very fair farms.

The region about Arbacoochee is best known as a great center of gold-mining operations thirty years ago. Southeast of Arbacoochee for 5 or 6 miles there are hilly or mountainous lands, with mica slates near the surface, thinly covered with soil, in consequence of which there is but little in cultivation. These harder slates alternate with others containing a good deal of hornblende (an iron-bearing mineral), and as the hornblendic rocks disintegrate quite readily, their positions are usually marked by valley-like depressions with a red or yellow clayey soil, which support a growth of white, red, and Spanish oaks, sour gum, walnut, and hickory. Pennyroyal, a lime-loving plant, is found in most of the fence corners where this soil predominates. The red soils of this kind are considered best for corn and other grains, but they are not so good for cotton. In good seasons they are quite productive, but are inclined to be droughty.

The lower part of this county is characterized by the predominance of red lands, a belt of which, 5 or 6 miles in width, crosses the county almost east and west near its southern boundary. The soil is a yellowish-brown loam, which for most crops is very productive. Throughout the county the gray soils greatly predominate, the red soils, with which they alternate, being usually in comparatively narrow belts. As showing the average composition of the red soils, see analysis of a soil of this kind from Lee county (page 16). The gray lands are of widely different grades of fertility, according to the nature of the rocks from which they have been derived. The best of the gray soils are derived from a granitic rock, and are frequently found closely associated with the red soils just spoken of. Such soils rank in fertility among the best in the county, but they are not the most widely distributed. Gray soils derived from mica and clay slates make up the greater part of the lands of this region, and are found both in the uplands and in the lowlands, being in the latter position usually somewhat more sandy. The gray lands have a growth of the various species of oaks, and where the sandy material predominates there is a growth of oak and pine. The average composition of the gray soil of the better quality may be seen from an analysis of a gray soil collected near Opelika, in Lee county (see page 16).

The cotton production of Cleburne county is small, which is partly due to the fact that there is no railroad or navigable stream. Lying, as it does, along the northwestern border of the metamorphic regions, only a small proportion of its soils can be rated as first class.

ABSTRACT OF THE REPORTS OF JOHN R. MOTIS, OF EDWARDSVILLE, AND OF JAMES H. BELL AND DAVID V. CRIDER, OF ARBACOOCHEE.

(These reports refer to the region drained by Crane creek and the main fork of the Tallapoosa river.)

In general, the uplands away from the streams are rather poor, and most of the farming lands are found in the vicinity of the river and the creeks. The low bottom lands are not best suited to cotton, as the plant is late in getting started and liable to injury from early frosts. For this reason the uplands, though not so fertile, are preferred. Notwithstanding these objections to the bottom lands, they are much cultivated in cotton, on account of the generally inferior quality of the uplands. The bottom growth is a mixture of oaks, hickory, walnut, gum, etc. The top soil is usually a sandy loam of gray and yellowish to dark colors, 8 to 10 inches in thickness, with a subsoil in general somewhat heavier, and of gray to yellow and reddish colors, according to locality. The underlying rock also varies with the locality, being, however, some kind of slate rock at depths of from 6 to 10 feet. These soils, while best suited to corn, are yet, in places, well adapted to cotton. The other soil varieties are the red lands, which are best for grain crops, and the pine lands, with gray gravelly soils.

The chief crops are cotton, corn, wheat, oats, etc., but the soil is for the most part best adapted to corn, cotton, and oats. From one-third to one-half of the cultivated land is in cotton, which usually grows to the height of 2½ to 4 feet. It is specially liable to run to weed in wet seasons, but can be prevented by topping. Fresh land yields from 800 to 1,000 pounds of seed-cotton per acre, and a 475-pound bale of lint requires from 1,425 to 1,545 pounds. The fresh-land staple generally rates as middling. After five years' culture (unmanured) the yield decreases about one-half. Crab-grass, purslane, etc., trouble the farmer. Very little land is turned out; and if reclaimed, it produces well for a few years. There is little or no damage from the washing of hillsides.

The cotton is hauled in wagons as fast as it is ready for the market (usually from November to January) to the nearest railroad station (Cedartown, in Georgia, or Oxford, in Alabama) and there sold to merchants. The rate of freight from Edwardsville to Cedartown is $1 50 per bale.

RANDOLPH.

Population: 16,575.—White, 13,155; colored, 3,420.
Area: 610 square miles.—Woodland, all. All metamorphic.
Tilled land: 81,426 acres.—Area planted in cotton, 23,177 acres; in corn, 29,595 acres; in oats, 4,850 acres; in wheat, 10,156 acres; in tobacco, 44 acres; in sweet potatoes, 433 acres.
Cotton production: 7,475 bales; average cotton product per acre, 0.32 bale, 456 pounds seed-cotton, or 152 pounds cotton lint.

In Randolph county, as in other counties of this region, the rocks and their derived soils are disposed in belts which have a general northeastern and southwestern direction, and in crossing the county from northwest to southeast the relations of these belts may best be made out. The hornblendic rocks, which yield reddish and tolerably fertile soils and give rise to gently undulating topography, occupy the northwestern corner of the county, and another belt of a very similar nature is found in the southeastern portion, while the greater part of the intervening country is made up of mica and clay slates. The mica slates extend as far as the Little Tallapoosa river, beyond which comes a belt of the clay slates to Wedowee, and then a repetition of the mica slates as far as the line passing northeastward through Louina. The country made by the mica slates is in general rather broken and the soils somewhat sandy, and is not very fertile. The timber consists of the upland oaks and hickories, with long-leaf pines, the latter becoming in many places the prevailing tree. The clay slates give generally a stiffer and more fertile soil than the beds just mentioned, and the usual timber is oak and hickory, with very little pine.

Below Wedowee, to the limit above named, while the mica slates are most prominent among the strata, they alternate with gneisses, which in many places take the characters of granites. The soils derived from this class of rocks are about the best in the county, and, as showing their average composition, the reader is referred to the analysis of gray granitic soil from Lee county, given on page 16. The mica-slate soils are well represented in the analysis of a soil of that kind collected in Clay county (see page 16). South of Louina to the line of Chambers county the soils are mostly red, derived from the hornblendic rocks alluded to before. The subsoils are also red, and rest on yellowish and reddish stratified clays, which are nothing more than the decayed slates of the country.

In the southeastern part of the county, from Roanoke to the line of Chambers, the soils are sandy, and deep beds of white sand remind one of the southern counties of the state. The color of this soil is gray to whitish, and the timber is chiefly long-leaf pine, with black-jack and the other oaks which are so commonly found in the piny woods. The only rocks which are to be seen in this pine region are sandstones and siliceous rocks, and in many places the fragments of quartz-seams cover the ground. This is usually the case, however, near the edge of the pine region.

The drainage of Randolph county falls into two systems, the greater part being into the Tallapoosa river, a small area in the southeastern corner belonging to the Chattahoochee.

In its relations to cotton production Randolph stands between Cleburne and Clay on the one hand and Chambers on the other. It is remote from a market, and its soils are not the best suited to cotton, except in certain sections, which are mostly in the lower part of the county.

ABSTRACT OF THE REPORT OF JAMES H. RADNEY, OF ROANOKE.

(The region referred to lies within the drainage area of High Pine and Corn House creeks, tributaries of the Tallapoosa.)

The uplands are preferred for cotton culture, since in the lowlands the plant is liable to be late, to take the rust, and to be killed by early frosts before full maturity. The two chief varieties of soil are those of the gray and red uplands, which make at least three-fourths of the cultivated lands of the region described. For cotton culture the slopes facing the south or southeast are preferred to other localities. The timber upon these uplands consists of pines, oaks, and hickories, the preponderance of one or the other of these trees depending on the quality of the soil. The top soil varies from light sandy and gravelly to a rather heavy, clayey loam of gray to brown or red colors, resting on a subsoil of yellow or red clay (sometimes very sandy). The underlying material is a soft, rotten-slate chalk, which is found at a depth of from 4 to 8 feet. Of less importance in the cultivation of cotton, but important for corn and other grain crops, are the light sandy-bottom soils. These have a natural growth of white oaks, beech, and poplar.

The chief crops are corn and cotton; the former on lowlands, the latter on uplands. About one-half of the land is planted in cotton, which usually attains a height of from 2 to 6 feet, but is most productive at 3 or 4 feet. Deep culture will cause cotton to run to weed. The usual yield per acre is from 800 to 1,000 pounds, *i. e.*, from two-thirds to five-sixths of a 400-pound bale, and varies but little for the first ten or twelve years of culture. Rag-weed and hog-weed are most troublesome. One-tenth of the land originally in cultivation is turned out, but when such land is treated with manure it produces well. The slopes are generally much damaged by washings, and the washings of uplands are frequently hurtful to the valleys. The damage has to some extent been prevented by hillside ditching.

Cotton is sent to market chiefly in December and January, most of it being hauled in wagons to West Point, in Georgia, the nearest railroad station (30 miles from Roanoke), the freight charge to that point being $2 50 per bale.

CHAMBERS.

Population: 23,440.—White, 11,364; colored, 12,076.
Area: 610 square miles.—Woodland, all. All metamorphic.
Tilled lands: 149,283 acres.—Area planted in cotton, 70,934 acres; in corn, 49,306 acres; in oats, 9,258 acres; in wheat, 11,520 acres; in tobacco, 39 acres; in sugar-cane, 211 acres; in sweet potatoes, 1,038 acres.
Cotton production: 19,476 bales; average cotton product per acre, 0.27 bale, 384 pounds seed-cotton, or 128 pounds cotton lint.

The water-shed between the Chattahoochee and the Tallapoosa runs nearly north and south through Chambers county. The bedded rocks which form the substratum of this county all have the general direction of northeast and southwest, except in the southeastern corner, where their arrangement is quite irregular; and on this account the soils of different kinds are in belts which pass through the county from northeast to southwest. The soils are

essentially of two kinds, the red and the gray, and a northeast and southwest line through the county a few miles northwest of La Fayette would be about the dividing line between these two varieties. Toward the northwest the soils would be mostly gray, and toward the southeast mostly red; but in both divisions the predominant soil variety is marked by many belts and patches of the other varieties.

In the northern and northwestern parts of Chambers county, where the gray soils prevail, the country is rolling or gently undulating, and the timber species is of upland oaks, with long-leaf pine, the latter becoming the principal tree in some localities where the soil is sandy. In the extreme northwest the underlying rocks are slates, which have been thoroughly disintegrated in place and have been converted into stratified clays of a yellowish color, with a top covering of yellow or brown loam, constituting the soil and subsoil. These slates are always interbedded with seams of quartz, the fragments of which in some places completely cover the ground. The soils are of moderate fertility. Near Milltown the granite appears often at the surface as large areas of bare rock. The granitic soils are among the best in the county, and their average composition may be seen by reference to an analysis under Lee county, given on page 16.

The red soils are characteristic over more than half of the lower part of Chambers county, and the hornblendic rocks from which they have been derived are usually worn down by denudation rather uniformly, producing an undulating surface. The timber is mostly oak, and nowhere can more luxuriant groves of red, Spanish, white, and post oaks be seen than upon the rolling red lands of Chambers. These red lands, as stated elsewhere, are better suited to the production of grain than of cotton, though a considerable proportion of the latter crop is always planted. The red lands have from the first been selected by the farmers, and it is rarely that any large areas can now be seen that have not been cleared and put in cultivation. Most of the handsome residences of the prosperous planters of *ante-bellum* days are situated in the midst of these lands, and are surrounded with the splendid oak groves alluded to.

Chambers county forms a part of the great central cotton belt of the state, and its soils, particularly those in the lower townships, are well suited to the production of cotton. Such are the red and gray gneissic soils, of which mention has been made before. From La Fayette to the southern limit of the county the greater part of the land is in cultivation, and cotton forms nearly one-half of the crops cultivated. The greater part of the cotton crop is sold to merchants at La Fayette, Opelika, and West Point.

LEE.

Population: 27,262.—White, 12,217; colored, 15,045.

Area: 610 square miles.—Woodland, all. All metamorphic; but the rocks over about 250 square miles in the southern part of the county are covered with stratified drift, which yields the soils and subsoils.

Tilled land: 122,875 acres.—Area planted in cotton, 51,889 acres; in corn, 30,137 acres; in oats, 11,918 acres; in wheat, 8,697 acres; in rice, 10 acres; in tobacco, 11 acres; in sugar-cane, 208 acres; in sweet potatoes, 925 acres.

Cotton production: 13,189 bales; average cotton product per acre, 0.25 bale, 357 pounds seed-cotton, or 119 pounds cotton lint.

Lee county, though formed by the strata of the metamorphic series, has these rocks almost entirely covered over the southern half by the beds of stratified drift. In the northern half of the county the metamorphic or crystalline rocks are directly concerned in the formation of the soils, and it is necessary to a proper understanding of the kinds and distribution of these soils first to give a short account of the rocks which yield them. The greater part of the county is made up of gneisses or crystalline sedimentary rocks composed of three minerals, quartz, feldspar, and mica, in varying proportions, by reason of which variations in the quality of the rock and of the soil derived from it are brought about. Further variations are due to the circumstance that hornblende may partly or wholly replace the mica. The hornblendic rocks, in decomposing, give rise to soils which are deeply colored red by iron. In many places the feldspar is deficient, sometimes wanting, and the rock passes into mica slate, with a corresponding change for the worse in the soil produced from it.

In the southern half of the county, or rather traversing it in a northeastern and southwestern direction near its center, is a belt of limestone (magnesian) associated with beds of micaceous sandstone. These, especially the limestone, are generally covered with beds of drift, and therefore very slightly affect the soils; the sandstone, however, forms some hills with sterile soil in the southwestern part of the county near the line of Macon. Aside from the drift soils, therefore, the arable lands of Lee county may be classed as gray, red, and sandy, the gray soils, derived from the gneissic rocks, being most abundant, forming about three-fourths of the land, and varying considerably in fertility, as might be inferred from what has been said before concerning the rocks which furnish them (see analysis of an average soil of this kind from near Opelika, page 16). The red soils are next in abundance as well as in importance in cotton cultivation, and an analysis of one of these, also from near Opelika, has been presented on page 16. The sandy soils are of least importance here as in other places. The drift soils vary, as usual, between heavy clayey loams and light sandy loams, and as they are similar to those soils elsewhere an enumeration and description of them need not be repeated here.

Lee county, like Chambers, is one of the great central cotton counties. The soils best suited to the cotton-plant are the red and gray gneissic soils in the north and the loam soils of the drifts in the south, the latter characteristic of the gravelly hills region.

ABSTRACT OF THE REPORTS OF MR. JOHN T. HARRIS, OF OPELIKA, AND MR. C. H. M'CULLOH, OF BEULAH.

(These reports relate to the lands within the drainage areas of Osanippa and Hallawoka creeks and the Chattahoochee river.)

The soils, in the order of their relative abundance and importance in the cultivation of cotton, are the gray lands, the red lands, and the sandy lands. The gray soils constitute from a half to three-fourths of the arable lands of the county, the natural timber of which is short-leaf pine, all varieties of upland oaks, except the black-jack, which is comparatively scarce, hickory, and poplar; in swamps, ash, maple, and gum. This soil is a light sandy loam of prevailing gray color, passing occasionally into buff and yellowish. The average thickness to

change of color is from 3 to 6 inches. The subsoil is generally a little heavier than the surface soil, and is sometimes a yellowish or reddish clay, containing angular fragments of quartz. This subsoil is underlaid with the more or less decayed gneiss or mica slate from which it has been derived, and it is a not uncommon thing to see the subsoil passing by insensible gradations through the stratified clays into the unchanged rock. The red lands make up from a very small proportion to nearly one-half of the lands, but the red and the gray in some sections alternate with each other in such a way that it is impossible to map out their distinct areas except with a vast amount of close and accurate surveying. This soil is a light clayey loam, usually of brown, mahogany, and red colors, from 5 to 8 inches thick to a change of color. The subsoil in consistence is not much heavier than the soil, though perhaps commonly of a slightly darker red color. Like the gray soil, this also contains the angular quartz fragments. The red soils are considered best suited to corn and other grains, though cotton forms on this, as well as on the gray soil, two-thirds to three-fourths of the cultivated crop. The sandy soils in the neighborhood reported upon are of little extent, but are very generally planted in cotton.

The above-named lands are easy to cultivate in wet and dry seasons, being well drained, but rather early and warm. The crops are cotton, corn, wheat, oats, and sweet potatoes. The gray soil is perhaps best adapted to cotton and the red to corn and grain, but all the other crops generally succeed. From two-thirds to three-fourths of the whole area is planted in cotton, which varies in height from 2 to 4 feet, and is most productive when, say, 3 feet high. It runs to weed in wet weather in August, but this can be prevented by fertilizers and shallow culture. On fresh land the average production per acre is 600 pounds, or a half bale of 400 pounds of lint cotton. After 12 to 20 years' cultivation the loss in yield is at least one-third, and it then requires from 1,425 to 1,545 pounds of seed-cotton to make a 475-pound bale. Rag-weed and crab-grass are the greatest nuisances. From one-fourth to one-sixth of the land originally in cultivation is now turned out, but by the use of fertilizers such lands can be made to yield nearly or quite as much as when fresh. The slopes or hillsides are readily washed into gullies, and the valleys are injured by the washings of the uplands; but damage from these causes is being checked or prevented by horizontalizing and hillside ditching.

Shipments of cotton are made usually between August 15 and December 25. The crop is commonly sold to merchants in West Point, Georgia, and Opelika, Alabama, and by them shipped to market.

TALLAPOOSA.

Population: 23,401.—White, 16,108; colored, 7,293.

Area: 810 square miles.—Woodland, all. Metamorphic, all; but about 100 square miles in the lower part of the county are covered with stratified drift.

Tilled land: 143,175 acres.—Area planted in cotton, 41,200 acres; in corn, 41,415 acres; in oats, 9,106 acres; in wheat, 14,572 acres; in tobacco, 21 acres; in sugar-cane, 41 acres; in sweet potatoes, 408 acres.

Cotton production: 14,161 bales; average cotton product per acre, 0.34 bale, 486 pounds seed-cotton, or 162 pounds cotton lint.

There are no striking topographical features to be noticed in Tallapoosa county. The drainage is all into the Tallapoosa and the three principal tributaries on the east, Sandy, Blue, and Sougahatchee creeks, which have their sources near the water-shed between the Chattahoochee and the Tallapoosa, a ridge traversing Chambers and Lee counties. All the bedded rocks of the county are crystalline or metamorphic, and, like all strata of the region of crystalline rocks, lie in sheets whose outcropping edges have the prevailing direction of northeast and southwest. The soils derived from these rocks are disposed in parallel belts having the same general direction. Bearing these things in mind, a description of the agricultural features of the county may best be given by naming the soil belts which are crossed in succession in passing through the county from northwest to southeast.

As to color, there are two varieties of soils: the red and the gray; but the latter vary very greatly in respect to their fertility, as well as in respect to the rocks from which they have been derived, and in some cases, when derived from granitic rocks, rank among the best in the county. These have commonly a subsoil which is more or less reddish or yellowish in color. The characteristic timber consists of the species of upland oaks, with some short-leaf pine. When based upon siliceous rocks and mica slates, especially when these are very siliceous, the gray soils are sandy and have a light-colored sandy subsoil, and then the prevailing timber is the long-leaf pine, with its associates, black-jack and post oaks. Such soils stand low in the scale of fertility. Similarly, there are grades in the fertility of the red and yellow soils. Those derived from hornblendic rocks are of a deep-red color, are rich and strong, and are timbered with the upland oaks—white, red, Spanish, and post. Upon these the long-leaf pine is seldom seen. As has been before stated, the red soils are best suited to the grain crops. Another kind of reddish soil, derived from certain varieties of mica and clay slates, has a prevailing timber of small oaks, with very few pines. In addition to the above-named soil varieties there are the usual bottom soils, which are in their nature dependent upon the surrounding uplands, from which they have been washed; but as a rule the bottom soils are rather sandy, and in most cases are more fertile than the uplands.

As to distribution, in the northwestern corner of the county there is a small area in which the rocks are thick-bedded and approach granite in structure, and throughout this region the soils are red and gray, with red subsoils, and of rather exceptional fertility. Thence southeastward to Dadeville the country is made up of belts of light-gray sandy soils, timbered with long-leaf pines, alternating with light-yellowish sandy and loamy soils based on mica and clay slates, and supporting mostly oak growth. Subordinated to these are areas of red soils with red or yellow subsoils, but these do not become prominent till Dadeville is passed. Between Dudleyville and Dadeville there is much of this undulating country with oak and hickory growth, but a little northwest of the direct line between the two places runs a belt of long-leaf pine land with sandy soil, and in places, especially near the Tallapoosa river, in the vicinity of the line of Chambers county, there are deep beds of white sand, much resembling some parts of the state where the stratified drift forms the surface.

Below Dadeville, to the southeastern limit of the county, the red and gray soils, with red or yellow subsoils, prevail, with here and there a belt of sandy pine land. The red and the gray colors are about equally prevalent, and the soils about equal in fertility where both have the red subsoil. The agricultural characters of these two varieties are well shown in the abstract given on page 82.

South of the Sougahatchee creek to the lower end of the county the sands, pebbles, and loams of the stratified drift overlie all the country rocks, hiding them completely from view, except in the vicinity of streams. In this part of the county, therefore, these superficial beds are alone involved in the formation of the soils. In some parts

of the region thus covered with the drift there are beds of steatite, which will probably some day be of value. At Tallahassee the rocks cause cascades in the Tallapoosa river, and these have been utilized to furnish the power for one of the largest cotton factories in the state.

The chief cotton soils of Tallapoosa county are the red and gray gneissic soils and some of the lowlands of the river and creeks, and, in addition to these, the loams of the drift by which the southern portion of the county is covered. A large proportion of the cotton crop is produced in the southern sections, where there is a prevalence of the above-named soils. Toward the north and northwest the slaty soils are much less suited to the crop.

ABSTRACT OF THE REPORTS OF D. A. G. ROSS, OF CAMP HILL, DANIEL TAYLOR, OF NEW SITE, AND JAMES M. PEARSON, OF DADEVILLE.

(The second refers to the region drained by Emuckfau creek; the other two to the region of Sandy creek.)

About New Site the soils are mostly gray, with subsoils varying from a sandy clay to a rather stiff red clay. In the other localities the red and the gray soils are about equal in extent, the gray being, if anything, rather more abundant. The uplands are preferred for cotton, for the reason that in the lowlands the plant is likely to be late, and therefore to be killed by frost before maturity. Under all circumstances the use of ammoniated manures is recommended, as these cause the plant to mature early and escape the danger from frosts. The soils described are—

First. Gray soil. This soil makes from one-half to two-thirds of the cultivated lands of the county, and varies in fertility and in other respects with the varying quality of the subsoil, which is sometimes a red clay and sometimes sand or gravel. The timber in the first case is a mixture of oaks and hickories, poplar, ash, etc. When the subsoil is light, the long-leaf pine becomes a characteristic growth. The average thickness of the top soil is 6 inches. The underlying granitic rock, from which both soil and subsoil are derived, is found at varying depths from the surface.

Second. The red soils. These make from one-third to one-half of the cultivated lands of the county, being more widely spread over the southern half. The natural timber consists of oaks and hickories, with very few pines. The top soil is a fine sandy to clayey loam, 5 or 6 inches in thickness, with a subsoil of red clay, and is usually of a darker shade (brown) than the subsoil. The subsoil, as a rule, contains fragments of quartz or flint, the underlying original rock being found at varying depths. Of these two soil varieties the gray is best suited to cotton, the red to grain. On the light sandy gray soils the principal oak, which is associated with the pines, is the black-jack.

Third. Not more than one-sixth of the county is bottom land. The bottom soils are generally somewhat heavy, and are of colors and composition varying with the uplands from which they are derived. Their thickness is often great, from 1 to 5 feet. The subsoil is commonly of heavier texture, but lighter in color than the top soil, and is underlaid at varying depths by sand, gravel, and granitic and flinty rocks, according to locality.

Tillage is easy in light sandy and difficult in heavy red lands, and is easier for all lands in wet than in dry seasons. The chief crops are cotton, corn, oats, wheat, sorghum, sweet potatoes, etc., all being equally well adapted to the soil. The cultivated land is very nearly equally divided between cotton, corn, wheat, and oats. Cotton usually attains a height of from 3 to 3½ feet, and is most productive when nearly or quite at its full height. It is inclined to run to weed on fresh lands, especially with deep culture near the roots in wet seasons. Excess of weed can be prevented by shallow culture, by topping in July, and by the use of commercial fertilizers. Fresh land yields from 500 to 2,000 pounds of seed-cotton per acre, the average being, say, 800 pounds; a 475-pound bale requires 1,425 pounds of good and 1,583 pounds of average seed-cotton. The best fresh-land staple rates in the market as middling. The last picking after the bolls are frostbitten is light and inferior. After fifteen years in cultivation, lands originally thin will yield from 200 to 300 pounds of seed-cotton, but when originally rich the yield will be from 500 to 800 pounds. It requires from 1,425 to 1,545 pounds of seed-cotton from old land to make a 475-pound bale, and more seed-cotton from rich than from thin land to make a given quantity of lint. Crab-grass, rag-weed, hog-weed, and purslane are most troublesome. One-third of the old lands are not cultivated; but after several years of rest they produce nearly as well as when fresh. There is not much injury from washings except on coarse gravelly hillsides, which can be prevented by hillside ditching. Valleys are not hurt by the washings of the uplands unless clay is washed in to cover the soil. The damage from this source is usually prevented.

The cotton is sent off as fast as it is prepared for the market. Between September and March it is hauled on wagons to the nearest railroad station, usually to Opelika and Dadeville, and thence sent to different points north and east. The freight varies with the distance, the rate from Camp Hill to Opelika being $1 per bale.

CLAY.

Population: 12,938.—White, 11,870; colored, 1,068.

Area: 610 square miles.—Woodland, all. All metamorphic.

Tilled land: 57,972 acres.—Area planted in cotton, 13,921 acres; in corn, 24,503 acres; in oats, 4,834 acres; in wheat, 9,785 acres; in tobacco, 85 acres; in sugar-cane, 10 acres; in sweet potatoes, 237 acres.

Cotton production: 4,973 bales; average cotton product per acre, 0.36 bale, 513 pounds seed-cotton, or 171 pounds cotton lint.

One of the most prominent topographical features of Clay county is a high ridge (Blue mountain), composed of siliceous rocks, which runs northeast and southwest near its western boundary. With the single exception of Talladega creek, all the streams which have their sources in the hills of Clay county flow either southward or westward into the Coosa and Tallapoosa rivers. Talladega creek rises in the highlands east of this Blue Mountain ridge, and, flowing down the valley southwestward for 10 or 12 miles, turns northwest, and, cutting through the siliceous rocks of the mountains which form the western boundary of the county, flows out into the Coosa river across Talladega county. Approximately parallel with this ridge, and 6 or 8 miles distant from it toward the east, there is another ridge, which is formed chiefly of mica slates, with which, however, are associated ledges of quartz rock, which give rise to much rough and broken country. Between these two ridges there is a valley, which, with some interruptions, extends through the whole length of the county. In its upper portion, near the headwaters of Ketchapedrakee and Talladega creeks, this valley has the name of Fish-Head valley; in the lower part of the county it is called Horn's valley.

West of the Blue mountain (as the western ridge is sometimes called), out to the borders of Talladega county, the rocks of clay are all aluminous slates alternating with strata of quartzite, and the resulting soils are gray,

which are not very fertile. Where the siliceous rocks are most prominent, as upon the higher ridges, the soils are sandy, and support a growth of long-leaf pine; in other places the upland oaks are associated with the pines.

The soils of the valley lands above mentioned are of two kinds, red and gray, the former derived from the rocks which contain the mineral hornblende, and the latter from the mica and clay slates. These two varieties are in belts and patches, and it is impossible to give any detailed account of their relative distribution. The country from the eastern foot of the Blue mountain out to the vicinity of Ashland is in general rolling, though rising toward the east, and is made up of many alternations of mica and clay slates with the hornblendic rocks. Perhaps the most widely distributed soil is a brown loam resting on a yellow clay foundation and supporting a growth of red, black, and Spanish oaks, with a few chestnuts and hickories. A soil of this sort was collected near Mr. H. Watts', and the analysis of the same has been given on page 16. The soils of this class are good with favorable seasons, but suffer much from drought. Going eastward, the red color and stiffness of the soils increase, and at Candutchkee they have nearly the color and texture of some of the red valley soils of the adjoining county of Talladega. This red belt is next followed by a region made up of mica slates, which for great distances presents almost uniform characters. These latter rocks yield a brown soil with red-clay subsoil, and usually contains fragments of the much-decayed slate. The prevailing timber is post, red, and black-jack oaks, with some pines and hickories, the two latter, however, not very numerous. Soils of this kind may be seen from Delta to Hillabee, and probably in the continuation of the same direction to the lower limit of the county.

East of the ridge lands between Delta and Ashland, and a few miles below the latter place, there is a belt 4 or 5 miles wide of rather low, gently undulating country, called Flatwoods, covered with a mixed growth of oaks and pine, and having generally a gray and somewhat sandy soil. These flatwoods show a considerable variety as regards the fertility of the soils. Some are considered almost worthless, being too wet and too rocky for cultivation; but when good enough for cultivation the soil gives a fair yield, as all the cotton matures and there is no danger of its suffering from drought. Beyond the flatwoods, toward the southeastern corner of the county, there is first a belt 4 or 5 miles in width of granitic rocks, yielding a gray soil, which is usually quite fertile, and this belt is succeeded in the same direction by clay slates and micaceous and siliceous rocks, which give yellowish and gray clayey and sandy soils of no great value. In wet lowlands there is much of what is called "crawfishy" land, which is worthless unless improved; but by thorough ditching, turning under of green crops, and liberal applications of lime these make very good crops, and the crawfishy character disappears. They are also often much improved by simply allowing the washings from the red lands to settle over them.

Clay county has the disadvantage of being remote from market. The northwestern border of the county, being broken and mountainous, possesses comparatively few sections whose soils are well adapted to cotton production. The bulk of this crop in Clay is hence produced in the southern and eastern parts of the county. In the character of the soils cultivated in cotton Clay resembles Cleburne and Randolph on the one side and Tallapoosa and Coosa on the other, and the remarks there made apply also to the adjacent portions of this county.

ABSTRACT OF THE REPORT OF W. W. JENKINS, OF HILLABEE.

(This report refers to the drainage area of Enitochopka, Hillabee, and Hatchet creeks.)

The lowlands consist of first bottoms, which are generally sandy, and of gray, black, and yellowish colors; of second bottoms, which are more or less rolling, containing but little sand, and have gray, yellow, and red colors; and of flatwoods, a body of land 12 miles by 8 in extent, mostly with gray, sandy soil, interspersed with patches of black pine-swamp land, with yellowish soil. The flatwoods have a growth chiefly of long-leaf pine, with black-jack and other oaks, some hickory, sweet gum, walnut, poplar, and patches of crab-apple, persimmon, ash, maple, dogwood, alder, etc., on the branches, and occasionally a bush of cedar. The flatwoods are of average fertility, and are not droughty. The first bottoms are exceedingly productive; the second bottoms less productive, but surer of a crop than the first bottoms. The uplands consist of several varieties. The table-lands are very productive where hickory is found in abundance. Where the sides of the hills are heavily timbered with oaks, hickory, and poplar, with no undergrowth, there are many farms, even on steep hillsides, for the soil is always good. Many of the hills are covered with chestnut, chincapin, and sassafras, and are not much valued. A large proportion of the pine land is not considered worth cultivating, and many spots of good soil cannot be cultivated because of the great number and size of the rocks which cover the ground. In general, the summits and southern and eastern slopes of the hills are most heavily timbered and productive. The generally mountainous character of this county, with the early fall, late spring, and usually cool summers, makes the cotton season very short. The caterpillar comes late, and generally does more good than harm by exposing the bolls to the sun. Guano is much used to hasten the growth and maturity of the cotton-plant. The gray lands, which predominate, are the freest and warmest, and give best returns. The first bottoms are generally too cold, and the weed grows so rank that the plant rots and molds; they are also too much shaded by the hills. The second bottoms are generally rolling, with no hills so high as to shade them too much. The flatwoods, though the soil is only of moderate fertility, yield good crops, because they are warmer, more exposed to the sun, and are visited by frosts often some weeks later than the other lands. Wet winter and spring are considered most injurious to the cotton crop, as it takes the land in the flats and bottoms a long time to dry and become warm.

The most prominent characters of the principal soil varieties have thus been given. In the order of productiveness they would rank about as follows: the best uplands, whether red or gray, are indicated by a growth of numerous long hickory saplings; the black pine-swamp land, when properly drained, is very productive; while the yellow lands are the poorest of all. The uplands and flats are very easy of tillage, but the bottoms, being wet and rich, are likely to be overrun with grass, which is hard to manage.

The principal crop is cotton, which is cultivated on about one-half of the tilled land. The plant grows to the height of 4 or 5 feet, being most productive at 4 feet. The causes which incline the plant to run to weed are wet weather, too rich land, too much manure, and too much distance between the plants. Topping is suggested as the best remedy. From 400 to 700 pounds to the acre may be taken as the average yield of the fresh land, and about 1,485 pounds are needed to make a standard bale. The staple from fresh lands is usually better than that from land long in cultivation, since it is not so likely to be stained by the subsoil. After a number of years' cultivation (without manure) the yield is brought down to 300 pounds to the acre, with about the same proportion of lint to seed, but with somewhat inferior fiber, as it is shorter, less oily, and more brittle. The most troublesome weeds are the hog-weed, crab, and "hurrah" grasses.

One-fourth of the land formerly under cultivation is turned out. When again taken in, the yellow soils appear to be exhausted; but the black soils seem to be brought to life by a few years' growth of young pines, and if they have not been burned over and the straw been allowed to rot on the ground produce as well as ever. The uplands are all more or less easily washed, and the injury from this source is considerable. When ditching is resorted to, it is to save the uplands, since the lowlands are rather improved than injured by the washings from the uplands. Where the hillside ditches are properly cut they protect the uplands very effectually.

The shipping of cotton begins in September, and is made by railroad, principally to Savannah, Georgia, at the rate of $1 per bale.

COOSA.

Population: 15,113.—White, 10,050; colored, 5,063.
Area: 670 square miles.—Woodland, all. All metamorphic.
Tilled land: 80,791 acres.—Area planted in cotton, 26,468 acres; in corn, 29,990 acres; in oats, 5,325 acres; in wheat, 9,735 acres; in tobacco, 28 acres; in sweet potatoes, 412 acres.
Cotton production: 8,411 bales; average cotton product per acre, 0.32 bale, 456 pounds seed-cotton, or 152 pounds cotton lint.

The drainage of Coosa county is westward into the Coosa river, with the exception of a small strip along the eastern edge of the county, which is within the drainage area of the Tallapoosa. The water-shed between Paint creek and Weoguffka is a prominent ridge of siliceous rocks, which runs northeast parallel with the course of Paint creek, and very near it. This ridge divides into two nearly equal parts the northwestern quarter of the county, over which prevail soils of a light or gray color and sandy texture, with a timber growth in which the long-leaf pine is always conspicuous and, at times, the principal tree. The underlying rocks, however, from which these soils are derived differ on the two sides of this ridge. Northwestward to the limits of the county these rocks are siliceous and clay slates, with sandstones and a narrow belt of limestone in the extreme northwestern corner; southeastward, over a belt 6 miles in width, the prevailing strata are micaceous slates, usually much disintegrated, and often filled with garnets. In the direction of the river the country is much broken, and the hills bordering the streams are in some instances 400 or 500 feet above the water-level. Where the siliceous dividing ridge above noticed is cut by the Coosa river high cliffs overlook that stream, and near the southeastern limit of this belt, and between Weoguffka and Hatchet creeks, up to the Talladega county-line, steep, high ridges are numerous. Most of these hills are covered with long-leaf pine forests and are uncultivated, but hold apparently inexhaustible deposits of iron ore, which may some day be utilized.

Southeast of a line drawn from the mouth of Hatchet creek to the northeastern corner of the county alternating red and gray soils are distributed over a surface which is, in general, more undulating and less broken than that just described. The underlying rocks are also different, consisting chiefly of gneisses and granites, and the presence of the mineral hornblende in many of these imparts to the soils derived from them a red or brown color. The subsoils, even of the gray varieties of soil, are mostly of reddish colors, and are usually called red clays. Between Bradford and Rockford stretches a belt of granite, which in places may be seen as huge bowlders, resulting from the disintegration of the mass. The resulting soils vary from mulatto-colored to gray, and are of varying degrees of fertility. The timber upon the red soils is chiefly oaks and hickory, and that upon the gray soils the same, with the addition of pine. The short-leaf pine is in places associated with the other trees mentioned both on red and on gray soils, but the long-leaf pine seems to grow in force only upon the lighter-colored, sandier soils.

In the vicinity of the Coosa river, and near the lower line of the county, there is a tolerably wide terrace or river plain, some 150 or 200 feet above the water-level on an average, on which the underlying rocks are mostly hidden from view by the beds of sand and pebbles of stratified drift. In this region the drift alone is concerned in the formation of the soils and subsoils, since the country rocks are exposed only along the banks of the streams, and the aspect of the country is in nowise different from that which prevails over some of the southern counties of the state. In addition to the soil-varieties above mentioned, there are the usual bottom soils which take their character from the uplands from which they are washed. Over all that region where the soils are closely connected with the stratified rocks angular fragments of the quartz veins, with which these rocks are traversed, are commonly seen on the surface and in the subsoil; but as a general rule these quartz fragments are more numerous upon the gray than on the red lands.

The red and gray gneissic soils, and those of the lowlands of the various streams, especially of the Coosa river, form the best cotton lands of Coosa county. In the northwestern section the lands are much more broken and the soils less suited to cotton than is the case elsewhere. The superiority of Coosa to some of its neighboring counties in the matter of cotton production is doubtless due to its greater proportion of good river lands.

ABSTRACT OF THE REPORTS OF J. C. M'DIARMID, OF GOOD WATER, AND JUDGE J. S. BENTLEY, OF ROCKFORD.

(Both these reports refer to the lands drained by Hatchet creek, the former to the northeastern part of the county, the latter to the central portion.)

The lowlands and bottoms are in some parts not planted to any great extent in cotton, but in some cases, where they are not too wet, or are properly underdrained and fertilized, they are the best cotton lands, since the plant grows to perfection and matures and opens fully before frosts. In the bottom lands there is more depth of soil and more vegetable matter, and consequently the plant never fires or sheds, even in long droughts and when heavily fertilized. The two varieties of upland soils described are the red and the gray (the latter being the gray granitic soil, and not the sandy and siliceous soil prevailing in the northwestern part of the county).

First. The gray land makes about 60 per cent. of the area described. It is timbered chiefly with oaks, hickory, and pines, the latter mostly on the uplands. The top soil is a sandy to a clayey loam of gray and other light colors from 3 to 8 inches in thickness, with a subsoil of heavier texture and usually of a reddish or yellow color, containing angular fragments of quartz or flint. The subsoil is mostly quite pervious or leachy.

Second. The red soils make up the other 40 per cent. of the uplands, and have the usual oak and hickory growth. The top soil is a clayey loam of yellow, red, and brown colors, 6 or 8 inches in thickness on an average, resting on a subsoil of stiff, tenacious clay, which is of a yellow or mahogany color and rather impervious and difficult to break up at first, but which, on exposure, becomes brittle, and is then easily worked.

Tillage is easy on gray but rather difficult on red lands in dry seasons. The chief crops are cotton, corn, oats, wheat, sweet potatoes, and sorghum, the soil being best adapted to the production of the three crops first named. From one-third to two-fifths of the land is planted in cotton. Cotton is usually about 3 feet in height when grown, and is then most productive. It inclines to run to weed on fresh lands and alluvial soils, but this may be prevented by the use of commercial fertilizers. The yield of cotton per acre on fresh land is about 800 pounds, or two-thirds of a 400-pound bale. After fifteen years' cultivation (unmanured) the same land will yield from 200 to 500 pounds only per acre; but the same amount of seed-cotton (1,425 pounds) will be required for a 475-pound bale. Crab-

grass is the most troublesome of all grasses and weeds. Perhaps one-half of all the land at any time in cultivation now lies turned out; but the turned-out portion is being rapidly reclaimed, and when reclaimed is almost as productive as fresh land. In some cases the washings of the slopes or hillsides is very damaging; but the injury from this source is of no great extent, and consequently no measures have been taken to prevent it.

Cotton is shipped generally when a mortgage is foreclosed. The usual point is Opelika, and the rate of freight $1 per bale. Most farmers sell to merchants at the nearest railroad station.

TALLADEGA.

(See "Coosa valley region".)

CHILTON.

(See "Gravelly pine-hills region".)

ELMORE.

(See "Gravelly pine-hills region".)

MACON.

(See "Central prairie region".)

REGION OF COOSA VALLEY AND ITS OUTLIERS.

Comprising the whole or a part of the following counties: Cherokee, Cleburne,* Calhoun, Etowah, Saint Clair, Talladega, Shelby, Chilton,* Bibb,* Tuscaloosa,* Jefferson,* Blount,* Marshall,* Jackson,* and De Kalb.*

CHEROKEE.

Population: 19,108.—White, 16,418; colored, 2,690.

Area: 660 square miles.—Woodland, all. Coal Measures of Lookout mountain, 150 square miles; Coosa valley, etc., 510 square miles.

Tilled land: 88,819 acres.—Area planted in cotton, 24,388 acres; in corn, 33,373 acres; in oats, 7,477 acres; in wheat, 10,085 acres; in rye, 163 acres; in tobacco, 82 acres; in sweet potatoes, 335 acres.

Cotton production: 10,777 bales; average cotton product per acre, 0.44 bale, 627 pounds seed-cotton, or 209 pounds cotton lint.

The western boundary of Cherokee county runs along the top of Lookout mountain, in many places near its western crest. A belt of varying width along the northwestern edge of the county, but averaging perhaps 5 or 6 miles, is thus made of the sandstones and other strata of the Coal Measures. The soils derived from these are sandy loams of grayish to yellow colors, and the prevailing timber is a mixture of the upland oaks and short-leaf pine. For fruit cultivation these mountain summits have been found to be especially well-suited, as the crop is rarely injured by frosts.

Parallel with the southeastern edge of Lookout mountain, and at the average distance of about a mile from it toward the southeast, runs a red-ore ridge through the whole length of the county, and between this ridge and Lookout mountain lies a valley with a yellowish soil of very fair character, similar to that found in Dry valley. The red-ore ridge is of the usual character, sandy on one side and flinty on the other, and has steep slopes. Another similar ridge, called the Dirt-Seller mountain, runs parallel with this from the Georgia line to Round mountain, on the Coosa river, with one interruption, caused by the Chattooga river. The Dirt-Seller is in reality a V-shaped mountain, with the apex of the "V" just beyond the line in Georgia, one prong (the longer one) terminating at the Round mountain, and the other (the shorter one) terminating at Gaylesville. The country between these two prongs is known as Dry valley, and is a good farming area, the soils being brownish and yellowish loams. An analysis of a typical soil of this valley has been given in the general part. The country between the Dirt-Seller and the red-ore ridge at the foot of Lookout mountain is in general ridgy land with gray, flinty, gravelly soils. Across the Chattooga river, south from Gaylesville, and reaching into this state a few miles from the Georgia line, there is still another red-ore ridge, called Gaylor's mountain. All this part of the county, included in a triangle lying north of an east and west line through Round mountain and Cedar bluff, is mountainous and ridgy, with the ridges and valleys running northeast and southwest; but below that line nearly to the southern boundary of the county the country is comparatively level, a large proportion of it being what is known as Flatwoods, which form a belt 4 or 5 miles in width, occupied by the windings of the Coosa river, and is generally timbered with post oaks and short-leaf pines, with occasionally other oaks. The flatwoods soil is a cold, yellowish-gray material, sandy in places, and in places very tough and clayey. (See analysis of soil from Saint Clair county, page 20). Probably on account of the level character of the land and its bad drainage the flatwoods are not, as a rule, much in cultivation, though the analysis shows that they are by no means sterile soils.

Southeast of the flatwoods belt, to the mountainous region in the lower part of the county, the land is gently undulating, and the surface soil is sandy and mixed with rounded pebbles of quartz, precisely similar to the pebbles of the drift farther south. This sandy land has a characteristic growth of long-leaf pine with black-jack oaks, the genuine piny-woods timber, and the pine belt extends through the county into Etowah without material change. Both the piny-woods and the flatwoods belts are based upon siliceous and calcareous shales, and where the soil is

not too sandy on the one hand (from the overlying drift sands) or too clayey on the other (from the shaly portions of the country rock) it is sometimes very good cotton land. The cutting of pine timber gives occupation to a large number of the inhabitants of this belt, and "log-yards" are established at every convenient bluff along the river. Toward the southeastern edge of the piny woods, where the surface drift has not so completely covered the country rocks, there are many strips of long-leaf pine land, with soil derived from a siliceous sandstone, alternating with strips of loamy land derived from calcareous shales, having a growth of post oaks and short-leaf pines. This whole area—flatwoods, piny woods, and the mixed land just mentioned—is less generally under cultivation than the other parts of the county.

As we approach the southern and southeastern limits of the county the topography becomes much varied, and mountainous elevations, composed of sandstone and chert, rise up abruptly from the general level, making short ridges of 5 to 10 miles in length, and often over 1,000 feet in height above the surrounding country. These mountains are of two kinds, sandstone and flint or chert, those formed of the sandstone being the higher and the more important. They inclose coves of red fertile valley land, such as is described under Calhoun and Talladega counties, and alternate in the most irregular way with the flint ridges. The sandstone mountains are timbered usually with oaks and short-leaf pines, while the characteristic growth of the flint ridges is the long-leaf pine. Upon these flint ridges lie strewn immense masses of light-gray or whitish chert, and if the soils were much more fertile than they are in reality these flint fragments would offer serious obstacles to cultivation. In a similar way the sides of the sandstone mountains are covered with huge fragments of that rock. In the coves, and often upon the sides of these mountains and hills, lie the most valuable deposits of brown iron ore, which is worked up at numerous furnaces along the Selma, Rome, and Dalton railroad. This railroad in Cherokee county runs chiefly in coves between the sandstone mountains which occupy the southeast corner of the county.

Between this group of mountains and the Coosa valley proper, before described, there is a region of ridgy and valley lands, with good red- and brown-loam soils, based on limestones; and beyond these rises the Wisenar mountain, a ridge of sandstone, flanked on the eastern side with lower ridges of chert. The Wisenar is about 6 miles long, and its lower or southern end is nearly in the southwestern corner of the county.

The cultivated soils of Cherokee are in general terms to be classed as red and brown loams derived from limestones—gray, flinty gravel soils, which, as a rule, cover the ridges which traverse the valleys, and sandy soils near the river based upon the drift. To these might be added the sandy and flinty soils of the mountains, which are, however, not much in cultivation.

The relations of Cherokee county agriculturally are very well shown in the following abstract. The high product per acre shows that the better lands are selected for cotton.

ABSTRACT OF THE REPORT OF DR. JOHN LAWRENCE, OF CEDAR BLUFF.

The lowlands of the Coosa, Chattooga, and Little rivers, and Terrapin and other creeks, embrace a small proportion of black alluvial soil and close mulatto and coarse white sand in some localities. The uplands comprise the mountainous, hilly, rolling valley and table-lands near these rivers, with post-oak flats and pine woods, the soils being quite varied, embracing many qualities, and the flatwoods and long-leaf pine sections are almost valueless for cultivation. The river and creek bottom lands, together with the valley and table-lands, are the most productive.

Cotton culture in the region described has greatly improved within the last few years. Wet weather in the spring frequently retards planting, and drought in July and August causes shedding. We also have cut-worms and lice in the early stages of the plant, and caterpillars and rust later. The most important soils in the cultivation of cotton are:

First. The light mulatto-colored and gravelly lands of the valleys and of the table-lands near the river. These are sandy loams, timbered with oak, hickory, chestnut, short- and long-leaf pine. The lands near the river are rather lighter and more sandy, but more even and of smoother texture than the long-leaf pine soils. These are usually lightly timbered, and are easily cleared and cultivated, but very quickly exhausted; yet the subsoil in most cases is heavier, and when mixed with the surface soil is greatly improved, especially for cotton production. In both soil and subsoil the brighter the color the better the quality.

Second. The ridge lands having usually gray or light-colored soils, with yellowish subsoils, containing angular flinty gravel, and supporting the usual upland growth of oaks and hickories.

Third. The light-colored and mulatto sandy soils of Lookout mountain, with yellowish subsoil, and an upland growth of oaks, hickory, and short-leaf pine.

All the soils that are profitably cultivated have subsoils of dull yellow and red colors, usually of finer texture than the surface. In addition to the above there are some valley soils that are considered scarcely worth cultivation. These are (1) the long-leaf pine lands, which have a thin sandy soil and yellowish to nearly white clayey subsoil in the low grounds, but of darker colors on the elevated lands, frequently covered with rounded pebbles; (2) the flatwoods, which have a very thin soil, and a subsoil of white or light-gray crawfishy clay, containing in many places flat fragments of the shale from which it is derived. The soil and subsoil are often much alike, containing always more or less lime, and rotten lime-rocks may be found underneath in most localities. Both the pine lands and flatwoods are burned over every year, and hence there is no accumulation of vegetable matter.

All the cultivated lands are of easy tillage if properly prepared and with favorable seasons. They are rather cold and imperfectly drained as a class, and are well adapted to cotton, corn, wheat, oats, and pease. From one-third to two-fifths of the cultivated lands are in cotton, which attains a height of from 2½ to 6 feet, being most productive at 3½ feet. The plant inclines to run to weed with deep culture and good seasons, and, to prevent this, in its early growth it should have deep tillage, but afterward tillage should be quite shallow.

On fresh soils the seed-cotton product per acre, with proper cultivation, varies from 500 to 1,200 pounds, of which 1,425 pounds are required to make a 475-pound bale, the staple rating as low middling to middling when properly handled. After twenty years' cultivation without manure and without rest or rotation the yield would be light, say from 100 to 1,000 pounds, according to the original strength of the land. In these cases the proportion of lint would probably be less and the staple shorter. The most troublesome weed is crab-grass, but briers and other weeds are often bad.

Not more than 10 or 15 per cent. of the originally-cultivated land is turned out, and when this is again taken into cultivation it produces very well, especially if fertilizers are judiciously applied. The rolling lands are quite easily injured by washings, and the damage from this cause is often serious. But little, if any, injury is done to the valley lands from such washings. The only remedy as yet applied has been horizontalizing, and in the few instances where this has been properly done the results have been satisfactory.

Cotton is shipped, as fast as prepared for the market, by boat to Rome, Georgia, at about 75 cents per bale.

CLEBURNE.

(See "Metamorphic region".)

CALHOUN.

Population: 19,591.—White, 14,134; colored, 5,457.

Area: 640 square miles.—Woodland, all. Coosa valley, 610 square miles; Coosa coal-fields, 30 square miles.

Tilled land: 93,857 acres.—Area planted in cotton, 26,435 acres; in corn, 33,714 acres; in oats, 8,852 acres; in wheat, 10,745 acres; in rye, 287 acres; in tobacco, 29 acres; in sweet potatoes, 283 acres.

Cotton production: 10,848 bales; average cotton product per acre, 0.41 bale, 585 pounds seed-cotton, or 195 pounds cotton lint.

The western boundary of Calhoun county below Greensport is formed by the Coosa river; above that town by a red-ore ridge, which enters this county from Saint Clair. The eastern boundary is formed by a continuation of the same mountains which form the eastern limit of Talladega county. These mountains are the highest within the county limits, and the next most important heights are found in the sandstone mountains which traverse the county northeast and southwest, in general east of the Selma, Rome, and Dalton railroad, and at no great distance (6 to 8 miles) from the eastern boundary. One range of these mountains extends without serious break from near Cross Plains down to the vicinity of Oxford. At this place there is a gap, and the continuation of the range, under the name of Coldwater mountain, is found on the western side of the railroad. Besides this principal range there are several smaller peaks or spurs on each side of the main body of the mountain. The long range may be called the Jacksonville or Ladiga mountain, and plays an important part in determining the direction of some of the water-courses of the county, the tributaries of Terrapin and Choccolocco creeks having their sources east of this range in the valley between it and the mountain which forms the eastern boundary of the county. The latter stream flows southward down this valley to near the southern line of the county, and then turns westward through a gap and falls into the Coosa; the former, on the contrary, flows northward around the end of the mountain through a similar gap, and thence northwestward through Cherokee county into the river. The other streams of the county rise on the western side of the sandstone range. The valley drained by Choccolocco and Nance's creeks is based on the flinty magnesian limestone, and presents the usual fluted structure—flint ridges, alternating with fine valley lands with red soil. The red soils prevail in the lower levels, while gray gravelly soils characterize the uneven ridgy lands. West of the mountain range spoken of the country presents the same alternation of flint ridges and red valley lands out to a series of hills of sandstones and other rocks of the Coosa coal-field, which occupies a narrow belt of 4 or 5 miles' width near the northwestern boundary of the county. In this intermediate region between the two mountainous and hilly tracts just specified there is a large area of fine valley land with the usual red and brown soil, resting on red clay loam. The region about Alexandria is of this character, and some of the most desirable farms in the county are in this belt, which extends through its whole length.

The red level lands are, as usual, separated by flint ridges, and all the varieties between the deep-red and the light-gray gravelly soils are to be found. An analysis has been made of a red valley soil from near Jacksonville (see page 22). In the upper part of the county the flint ridges often broaden out, embracing large areas, which have the usual gray sandy, gravelly soil, changing to yellowish at 2 or 3 inches, and resting on a yellow clay at 3 feet depth. This soil supports a growth of long-leaf pine, with post and Spanish oaks and small hickories. In general, the flint ridges of this kind nearly always have a growth of long-leaf pine, and in the northeastern part of the county, where the sandstone mountains and the flint ridges are in close proximity to each other, the former have mostly oak timber, while the latter have the pine. In some instances, however, pine grows also upon the sandstone soils. At the northwestern border of the county the flint ridge which forms a part of the red-ore range is of different quality, being clothed with oak growth, without pine.

The low hills of the Coosa coal-field, while crossing the northwestern corner of the county, have little influence on the topography, as they have been much worn down, and the soils derived from them are, as usual, sandy and rather poor, in striking contrast to the rich red soils of the adjacent valley.

The valley lands of Calhoun are usually selected for cotton planting, as is the case in this section generally, and the high product per acre may be taken as indicating the superiority of the soil. The soils of the other counties included in the Coosa Valley region, viz, Etowah, Saint Clair, and Talladega, are of the same nature as those of Calhoun and Cherokee, and the relations of all these counties to the production of cotton are practically the same.

ABSTRACT OF THE REPORTS OF DR. S. C. WILLIAMS, OF OXFORD, AND T. W. FRANCIS, OF CANE CREEK.

(The first of these reports refers to the region about the Choccolocco (eastern valley), the second to that about Cane creek (western valley), and both relate to uplands as well as lowlands.)

In the lowlands the cotton is liable to rust, especially on old land, say from five to thirty years in cultivation. The lowlands are therefore better suited to wheat and oats, but good crops of cotton are made on them when fresh. For many reasons the uplands are preferred for cotton, especially if the soil is of fair quality, which is generally the case for 10 or 12 years, after which time it usually requires fertilizers. Late springs and early frosts tend to reduce the crop. The most important soil is a reddish or mulatto soil, which makes about two-thirds of the cultivated land in the valley. The natural timber on such land is red, black, white, post, turkey, and Spanish oaks, hickory, walnut, etc. The top soil is a gravelly, clayey loam of gray to brown and black colors, about 12 inches thick, with a yellow or red-clay subsoil, which becomes like the soil after cultivation. This mulatto soil grades into a gray soil in the hilly slopes, and the subsoil of both is a yellow clay, redder in the case of the mulatto soils. This subsoil always contains flinty or cherty gravel, and, in the red varieties, also pebbles of iron ore. The underlying rock is a limestone, which is reached at from 10 to 50 feet depth. From one-third to one-fifth of the land, according to locality, is bottom or made land, with a growth of beech, poplar, sweet gum, walnut, hickory, elm, ash, etc. The soil is a sandy or clayey loam from 1 to 5 feet in thickness, with a yellowish or bluish-white clayey subsoil, containing flinty pebbles, and resting on the limestone at varying depths. In the vicinity of Cane creek there is a soil variety

known as slate or post-oak land, which is timbered with post oak and black-jack, the top soil of which is a gravelly, in some cases putty-like, material, from 2 to 6 inches in thickness, and of a whitish color, and the subsoil a soft, black slate, which becomes hard on exposure to the air, and is then somewhat impervious. This land is not of much value, being almost worthless after a few years' cultivation. Upon the mountains there is a coarse, sandy soil of a whitish to gray color, 4 to 6 inches in thickness, with a subsoil which is like the surface soil, but has more flint intermixed with the white, sandy clay. All rest upon a flinty substratum. This soil supports a growth of long-leaf pine, mixed with black-jack and small trees, is the extreme of the flinty soils, and is found only on the ridges and mountain slopes. On account of its uneven and knobby character, it is liable to wash, and, being rather barren, is not much under cultivation.

Land is generally easily tilled in both wet and dry seasons. The chief productions are cotton, corn, wheat, oats, and rye, and the soil is well adapted to cotton and grain. At least one-half of the land is planted in cotton, which usually grows to a height of 3 feet. Deep culture and wet weather, one or both, cause cotton to run to weed, which can be obviated by shallow tillage and by "topping." Fresh land yields from 500 to 1,000 pounds of seed-cotton per acre, and it requires from 1,425 to 1,545 pounds of seed-cotton to make a 475-pound bale. Cotton from fresh land rates in market a shade higher than that from old land. The latter will not generally produce paying crops unless fertilized. All the best cotton land has been in cultivation from twenty to thirty years. Crab-grass and rag-weed make necessary early and late plowing. The soil does not wash much on slopes or hillsides, but the valleys are rather benefited than injured by the washings from the uplands. Whatever damage may result from rain on the slopes can be readily prevented by hillside ditching.

Shipments of cotton are made as fast as the cotton is baled. From Cane creek neighborhood the shipments are by boat to Rome, Georgia, at the rate of 75 cents a bale; from the other side of the county the cotton goes by railroad to Selma, Alabama, or to Rome, Georgia, the freight being the same to either place, viz, $2 50 per bale.

ETOWAH.

Population: 15,398.—White, 12,896; colored, 2,502.

Area: 520 square miles.—Woodland, all. In Coosa valley, 250 square miles; in Wills' valley, 90 square miles; in Murphree's valley, 40 square miles; Coal Measures, 140 square miles (40 on Lookout mountain and 100 on Sand mountain).

Tilled land: 60,780 acres.—Area planted in cotton, 15.187 acres; in corn, 24,891 acres; in oats, 5,025 acres; in wheat, 7,063 acres; in tobacco, 47 acres; in sugar-cane, 9 acres; in sweet potatoes, 230 acres.

Cotton production: 6,571 bales; average cotton product per acre, 0.43 bale, 612 pounds seed-cotton, or 204 pounds cotton lint.

Etowah county includes portions of two mountain plateaus and three valleys. All these natural divisions have a northeastern and southwestern direction through the county. The valley of the Coosa forms the eastern and southeastern parts of the county, and, like most of the valleys of the state which depend upon the geological structure for their existence, is a complex trough, made up of several smaller valleys, divided by ridges. The river with its windings occupies the central part of this valley, which is a gently undulating plain of 5 or 6 miles in width. This plain is based upon a shaly limestone which yields a clayey soil, usually badly drained, and not generally under cultivation where the limestone is near the surface. In the vicinity of the river, however, these limestones, together with their resulting soils, have been pretty generally covered with a deposit of loam, sand, and rounded pebbles, and these materials are more concerned in the formation of the soils than the underlying country rocks. Upon such soils the prevailing timber is long-leaf pine, which follows the river plain throughout the county and into Cherokee. The marginal belts on each side of the main valley are fluted with smaller valleys, separated by flint ridges, and present the usual variety of yellowish clayey and gray gravelly soils, the latter predominating upon the hilly portions and the former upon the more level areas.

Another belt of valley land stretches southwest below Gadsden to the county-line and beyond. In this area the sand and pebbles are mostly wanting, and the soils are dependent altogether upon the shaly rock. This whole region is quite level, and has a cold, yellowish, clayey, badly-drained soil, covered as a rule with its original timber growth, chiefly of post oaks and short-leaf pines, with red, Spanish, and black-jack oaks, and occasionally sweet and sour gums. This belt has the name of "the flatwoods", and is comparatively little cultivated, although the natural growth and the chemical analysis, as given on page 20, would indicate a soil of very fair quality. The trouble seems to be more due to defective drainage and other physical causes. On each side of this flatwoods belt are found the cultivated lands of the valley, which are, as usual, disposed in belts of mahogany land, alternating with the gray gravelly land of the ridges.

From the northeastern corner of the county to Gadsden stretches the lower extremity of the Lookout Mountain plateau, which is capped with the rocks of the Coal Measures, yielding sandy or slightly loamy soils and supporting a growth of upland oaks and short-leaf pine. From this plateau flows Black creek, making, where it leaves the mountain near Gadsden, a fine waterfall, which is one of the attractions of that vicinity. Parallel with Lookout mountain toward the northwest, and separated from it by Wills' valley, is the entirely similar plateau of Sand mountain. Beyond Sand mountain a part of the northwestern boundary of Etowah county is formed by Murphree's valley. These two valleys are in all essential respects similar to each other, and their structure is already described at length in the general part.

The valley soils are principally of two varieties, the red or yellowish and the gray soils, and as a rule the former occupy the subordinated valleys between the chert ridges, upon which the latter are most commonly found. Several analyses of each of these soil varieties have been given in the general description. The sandy soils are chiefly confined to the plateaus of Lookout and Sand mountains. The extreme southeastern boundary of the county is formed by a high cherty ridge, and a similar ridge runs nearly parallel with this and 5 or 6 miles west on the opposite side of the river, terminating at a bend in the river a few miles below Gadsden. Between these is the wide valley of the Coosa.

In its relations to cotton culture Etowah corresponds closely to Calhoun, which it adjoins, and the remarks there made will apply here also.

ABSTRACT OF THE REPORT OF W. B. BEESON, OF GREENWOOD.

(This report refers to the drainage area of Little Wills' creek.)

All classes of uplands produce reasonably well when properly cultivated. As this is near the northern limit of the cotton belt, it is best, in order to escape damage from frosts, to stimulate the plant to early maturity by the use of fertilizers. On bottom lands liable to overflow there is no cotton planted because of overflow and of early frosts. The soil varieties described are:

First. The dark mulatto or mahogany, which makes about one-half of the cultivated lands of the two Wills' valleys, and supports a growth of oaks, hickory, chestnut, and walnut. The top soil is a sandy loam of a brown to mahogany color, 6 to 12 inches in thickness, with a subsoil of heavier clayey texture, resting upon the limestone rocks at varying depths.

Second. The gray and dark gravelly lands, which divide the areas of the two valleys about equally with the preceding, and which support nearly the same natural growth. The top soil is lighter both in color and in texture than the preceding, and the same is true of the subsoil; but the subsoil is heavier and contains more clay, and also, as a rule, contains angular pebbles of flint.

Third. The sandy soils upon Sand and Lookout mountains, having the usual characters of the mountain soils. These sandy lands are easily cultivated. Clay is more crusty after rains, and waxy when not so wet. The uplands are rolling, and hence naturally well drained. The chief products are cotton, corn, wheat, oats, millet, sorghum, sweet potatoes, and clover. All kinds of land are fitted for corn and sorghum, and all kinds of uplands are suited to cotton. About one-third of the cultivated land is in cotton, which grows generally to a height of from 3 to 4½ feet, the highest being most productive unless the rains have been excessive. On lowlands, and especially in wet weather, cotton runs to weed; but it is generally thought that the yield is increased by topping the plant in July and August. The seed-cotton product per acre is from 600 to 1,000 pounds. Land does not seem to be injured by the first four or five years of cotton culture; indeed, cotton does not exhaust the soil as rapidly as many other crops. Crab-grass is the worst enemy, but is not feared when the crop is worked often and well. Very little land that was ever in cultivation is turned out. The soil washes on sandy or gravelly slopes, and on some hilly farms the damage is very considerable, but the valleys are improved by the washings from the uplands. There is some hillside ditching to protect the slopes, which is beneficial when well done.

The greater portion of the cotton crop is hauled to Gadsden, some to other towns on the railroad, between October 20 and January 1. Very little is shipped by the producer.

SAINT CLAIR.

Population: 14,462.—White, 11,621; colored, 2,841.

Area: 630 square miles.—Woodland, all. Coosa and Cahaba valley lands, 430 square miles; Coal Measures, 200 square miles (Coosa field, 150; Cahaba field, 50).

Tilled land: 65,105 acres.—Area planted in cotton, 14,735 acres; in corn, 25,465 acres; in oats, 4,603 acres; in wheat, 9,841 acres; in tobacco, 53 acres; in sweet potatoes, 226 acres.

Cotton production: 6,028 bales; average cotton product per acre, 0.41 bale, 585 pounds seed-cotton, or 195 pounds cotton lint.

The northwestern boundary of Saint Clair county is formed by Blount mountain, which is the southern end of one of the prongs of Sand mountain, already known as a part of the coal-fields of the state. In the northwestern corner of the county Chandler's mountain, about 6 miles long and 2 miles wide, is of the same formation. The Coosa coal-field, occupying a belt some 5 or 6 miles in width, runs nearly parallel with the Coosa river, which forms the southeastern boundary of the county, and at an average distance from it of 3 or 4 miles. In addition to these the northeastern extremity of the Cahaba coal-field runs up into Saint Clair county as far as the latitude of Springville. Between these mountainous or hilly lands, which the Coal Measures always form, lie the main valleys—Coosa valley, between the river and the Coosa coal-field, and Cahaba valley, between the Coosa and Cahaba coal-fields. These valleys are themselves complicated by ridges running their whole length, dividing them up into narrow ribbons or subordinated valleys differing widely from each other.

It will thus be seen that Saint Clair county presents a great variety in its topographical and other natural features. The topography, soils, timber, and other characters of the Coal Measures are about the same everywhere, the lands upon the smaller ridges being of two distinct sorts. The red-ore ridges run always parallel to the edge of the Coal Measures, usually less than a mile distant, and are formed of sandstones and cherty limestones, the sandstones being commonly found on one side of the ridge and the chert on the other. These ridges are often high and steep, and form a prominent feature of the landscape. Their characteristic soil is a red calcareous loam, which is specially suited to the production of small grain, but not of cotton, the slopes being usually too steep to permit cultivation to any great extent. Where the red-ore feature is not prominent the chert or flint, which also enters into the composition of the ridges, becomes the characteristic, and the slopes are covered with its sharp angular fragments, the soil thus formed, while very rocky, being quite fertile, as is shown by the luxuriant growth which covers it. In this respect the Red Mountain chert ridges are, as a rule, to be distinguished from the chert ridges, which are based upon a lower formation, the former being often called oak ridges, while pine is a characteristic growth of the latter.

Between the red-ore ridges and the Coal Measures there is always a small valley of yellowish or mahogany-colored soil of more than average fertility. This soil is similar to that of the red lands of the valley of the Tennessee, and its composition is shown in the analysis of Dry valley soil from Cherokee county (see page 24).

Next to the red-ore ridges (toward the center of the valley) the land is at first rather level and of good quality; then succeeds the cherty, gravelly lands, interspersed with flint ridges of Lower Silurian origin. These have a gray gravelly soil of medium fertility (see analysis of the soil collected near Ashville, page 22). The red or yellowish valley soil from the same locality is the type of the other class of valley soils. These yellowish soils, like the gray, are more or less mixed with angular flinty pebbles, but occasionally a cove of fertile red land may be found inclosed by ridges of the white angular cherty gravel, Clayton cove, just over the line in Jefferson county, below Springville, being an instance.

From Springville northeastward along the line of the Alabama Great Southern railroad there is a level country called the "flatwoods" with cold, yellowish soil, very little cultivated, and mostly covered with its original growth of post oak and pine, and in places with other oaks and gums. This soil is derived from a shaly limestone.

Saint Clair closely resembles the other counties of this section, and, as regards cotton culture here, the remarks under Calhoun county will apply equally well.

ABSTRACT OF THE REPORT OF JUDGE JOHN W. INZER, OF ASHVILLE.

(This report refers to the region of Big Canoe creek, a tributary of the Coosa river.)

Wet, cold springs and summer droughts, more than anything else, injure the cotton in this region. The soils described are three, viz:

First. Gray upland soil, often full of cherty gravel. This makes about three-fourths of the cotton land of the region, but not quite one-half of the valley lands. The usual timber consists of oaks, poplar, and short-leaf pine. Along the Coosa river the soil is sandier, and long-leaf pine prevails. These are the best cotton lands. The top soil is a fine sandy loam in the bottoms and a gravelly loam on the uplands; color, gray; thickness, about 3 inches. The subsoil is a reddish or buff clay, except in the bottoms where it is sandy. It contains angular pebbles of chert or flint, and is underlaid at 20 to 25 feet by a siliceous magnesian limestone.

Second. Red or mulatto upland soil. This makes a little over a half of the valley lands of the county, but not more than a fourth of it is planted in cotton, since it suits the grain crops much better. The timber is oak, hickory, poplar, etc. The top soil is a clayey loam of the colors above given, and has an average thickness of 4 inches; the subsoil is also a clayey loam, heavier than the top soil, containing angular cherty pebbles, and frequently, also, concretions of brown iron ore. This is underlaid with the same magnesian limestone that forms the basis of the preceding.

Third. The sandy bottom lands. These make only one-tenth of the cultivated area, and are found along the Coosa river and Canoe creek. In the former locality there is much long-leaf pine associated with the other growth. The chief growth of the bottom lands is white and red oaks, poplar, and hickory. The top soil is a fine sandy loam of a dark-gray color 5 inches in thickness; subsoil heavier, being mixed with some clay. It also contains angular cherty pebbles like the others, and rests on the magnesian limestone at from 6 to 8 feet.

Land is easily tilled in both wet and dry seasons, as it is early, warm, and well-drained. The crops are corn, cotton, oats, and some wheat, but corn and cotton are best suited to the soil. One-half of the cultivated land is planted in cotton, which, unfertilized, grows 3 and 3½ feet high, and is generally most productive just before attaining full height. Cotton is inclined to run to weed in wet weather in July and August, which can sometimes be prevented by topping. Fresh lands generally yield 800 pounds of seed-cotton per acre, *i. e.*, two-thirds of a 400-pound bale. The fresh-land cotton is quoted as middling. After 5 years' culture (unmanured) the yield is from 650 to 700 pounds per acre, and it then requires 1,485 pounds of seed-cotton to the 475-pound bale. Crab-grass is the arch enemy. Not much land is turned out; and when such land is taken into cultivation again it produces for two or three years very nearly or quite as much as when fresh. The slopes or hillsides are often much injured by rains. Valleys are also injured by the washings of the uplands, which injury is checked on some farms by hillside ditching.

Shipments of cotton are made mostly in November, by rail or by steamer on the Coosa river, to Nashville, Selma, Mobile, and New York. The rate of freight to Nashville is $3 per bale.

TALLADEGA.

Population: 23,360.—White, 10,856; colored, 12,504.

Area: 700 square miles.—Woodland, all. All Coosa valley and ridge land.

Tilled land: 113,389 acres.—Area planted in cotton, 32,841 acres; in corn, 40,376 acres; in oats, 9,278 acres; in wheat, 13,235 acres; in rye, 143 acres; in tobacco, 30 acres; in sweet potatoes, 335 acres.

Cotton production: 11,832 bales; average cotton product per acre, 0.36 bale, 513 pounds seed-cotton, or 171 pounds cotton lint.

Talladega county lies between a range of high hills on the east and the Coosa river on the west. The water-courses, with the exception of Talladega creek, have their sources on the western side of this range, which in part of its course is called Blue mountain, and flows westward into the Coosa. Talladega creek has its headwaters in the mountains beyond the borders of the county, cuts its way through the highest of these, and flows thence southwestward into the river. The three principal streams of the county are, beginning at the north, Choccolocco, Talladega, and Tallasseehatchee creeks, which with the smaller streams (Blue Eye, Clear, and Cedar creeks) receive all the drainage of the county.

The highest elevations in the county are found in the range which makes the eastern boundary, Blue and Rebecca mountains. Next in point of height are the mountains of sandstone of the Lower Silurian age, which occupy the central parts of the county. These mountains, like all made by this formation, consist of detached ranges, which, rising up abruptly from the plains, extend 15 or 20 miles, and then sink down quite as abruptly at the other end, beyond which, after an interval of 5 or 10 miles, another similar range makes its appearance. West of the Selma, Rome, and Dalton railroad, from Choccolocco creek to Alpine station, a distance of 15 miles or more, one of the most prominent of these ranges may be seen. At Alpine the height of one of the peaks is 2,000 feet above the railroad, or 2,495 feet above the sea-level. Northeast of the city of Talladega the peak called Mount Parnassus is a prominent landmark in that vicinity. Below Alpine, the continuation of this range is found on the other side of the railroad, and its direction is changed to south and east, and near its eastern extremity is known under the name of Pope mountain.

The lower part of the county is mostly occupied by a number of short ranges and peaks which have the collective name of the Kahatchee hills. Near Childersburg and Coosa bridge these mountains approach quite near to the river. A prominent peak in this vicinity is 800 feet in elevation above the river. All the mountains of this character are formed chiefly of sandstone, with some calcareous shales, which, however, never become prominent. The resulting soils are necessarily sandy and of no practical value. An oak growth covers the sides and summits of all these ranges, but cultivation is out of the quest on, even if the soils were fertile, on account of the huge masses of rock which form the surface. Upon the summits there is a scanty growth of gnarled and stunted trees, chiefly oaks.

Between these mountains and the eastern border of the county, and also between them and the river, are the valley lands, which are far, however, from being uniformly level. Based as they are chiefly upon flinty and magnesian limestones, these valley lands are traversed by flint ridges, which have a direction from northeast to southwest, and which, in the eastern part of the county, lie between narrow belts of valley land with fertile red and brown soils. These soils and their subsoils are usually filled with angular fragments of flint, and where this becomes a prominent ingredient the red color disappears, and the soil as well as subsoil becomes gray. The gray lands are commonly rather more broken than the others, lying frequently upon the sides of the flint ridges above spoken of. The valley lands east of the mountain ranges before described constitute the most attractive part of

Talladega county, and it would be difficult to find anywhere a section which has greater natural advantages than the belt of country lying east of the railroad as far south as the Kahatchee hills. The timber of this region consists of red, black, white, Spanish, and post oaks, hickory, and gums.

Where the soils are of deep-red color the subsoil is mostly full of pebbles of brown iron ore, which are sometimes present in quantities sufficient to constitute true ore banks. Where these masses of iron ore cover the surface (even sometimes to the extent of seriously interfering with cultivation) the soil is nevertheless highly fertile. The gray or ridgy lands have a characteristic growth of long-leaf pine, but other trees, especially oaks, are associated with it.

West of the sandstone mountains spoken of, and especially in the vicinity of the river, the chert or flint very much predominates. In this region, which embraces a belt 4 or 5 miles in width along the river from Choccolocco to Talladega creeks, is a succession of chert ridges, with gray, flinty, siliceous soil, timbered almost exclusively with long-leaf pine, interspersed with lime-sinks. The chert is sometimes accumulated in hills of considerable size, as in Calhoun mountain, near the mouth of Talladega creek, which is at least 350 feet above the river level. In some localities, as northwest of Plantersville, these pine woods are gently undulating, and the cherty fragments only occasionally show above the surface. This whole region, because of the sterility of the soils, is comparatively uninhabited except along the banks of the very few creeks which traverse it, but it has its value as a range for cattle. Inclosed by these barren flinty hills are occasional coves of excellent land with red calcareous soils. Howell's cove, west of Talladega, may be cited as an example. In the region of the Kahatchee hills there are many fine coves of red, fertile soil, hemmed in on three sides by the mountains.

Near the eastern border of the county, below the Kahatchee hills, the beautiful Talladega valley extends quite to the southern limit of the county. In this section is situated the well-known sulphur spring. Of all the watering-places in the state this has the most attractive surroundings.

The valley lands of Talladega are well suited to the culture of cotton, as is shown by the comparatively high product per acre. The low percentage of tilled land in cotton gives evidence that other crops are more profitable.

ABSTRACT OF THE REPORTS OF H. M. BURT, S. M. JEMISON, AND A. W. DUNCAN, ALL OF TALLADEGA.

(These reports are descriptive of the soil varieties occurring throughout the valley east of the railroad.)

The principal soil is the red valley soil, which makes nearly three-fourths of the cultivated land of the area described. This is timbered with red, post, and black-jack oaks, hickory, persimmon, and sassafras. The top soil varies from a light, fine sandy to a rather heavy clay loam of mahogany to brown and nearly black colors, and is from 1 to 12 inches thick. The subsoil is usually heavier, being mostly a tough red clay, containing angular fragments of flint and rounded pebbles of iron ore. It rests upon lime-rock, which is found at the average depth of 20 feet.

A gray gravelly soil makes about one-eighth of the area embraced by the reports, which is timbered with pine, mixed with other trees, such as oaks and hickory. The top soil is a sandy, gravelly loam, occasionally a clay loam, of a whitish to gray color, with an average thickness of 2 inches. The subsoil is usually heavier and yellowish in color, containing flinty gravel in quantity, and is underlaid first with sand, and below that with the lime-rock.

Still another eighth of the region is made up of the first- and second-bottom lands, which have a growth of beech, poplar, sycamore, iron-wood, sweet gum, etc. The soil is a sandy loam of gray to blackish colors, and some 12 inches in thickness; the subsoil a tough clay, hard at first, but becoming soft by cultivation. It also contains flinty, angular pebbles, and is underlaid with sand and the lime-rock at varying depths.

Land is usually easily tilled both in wet and dry seasons. The principal crops are cotton, corn, wheat, and oats, but the soil is best suited to corn and cotton. From one-third to one-half of the land is planted with the latter, which is generally from 2 to 4 feet high when grown, and yields best at or about the full height. Running to weed in wet seasons can be prevented by topping and by the use of acid phosphates. The yield per acre on fresh land is about 1,000 pounds, and from 1,485 to 1,545 pounds are required for a 475-pound bale. Fresh-land cotton rates in the market as first-class uplands. After ten years' culture there is a falling off of 25 per cent. in the yield, and it then requires from 1,545 to 1,660 pounds of seed-cotton for a 475-pound bale. Crab-grass and hog-weeds are the most troublesome of all the weeds. About one-fifth of the land is turned out, but such land brought into cultivation again will, with suitable fertilizers, produce good crops. In some places there is serious damage done to the hillsides by heavy rains, but the valleys are rather improved by the washings of the uplands. This damage has been checked to some extent by horizontalizing.

The farmers rarely ship their own cotton, but sell it, as fast as it is ready for the market, to the merchants in the little inland towns. These ship it chiefly to Selma, Rome, and Montgomery. The average freight rates are $2 35 per bale.

SHELBY.

Population: 17,236.—White, 12,253; colored, 4,983.

Area: 780 square miles.—Woodland, all. Valley lands, 385 square miles (Coosa and Cahaba); Coal Measures, 395 square miles (Coosa field, 235 square miles; Cahaba field, 160 square miles).

Tilled land: 58,550 acres.—Area planted in cotton, 17,919 acres; in corn, 26,159 acres; in oats, 4,764 acres; in wheat, 6,294 acres; in tobacco, 10 acres; in sweet potatoes, 346 acres.

Cotton production: 6,643 bales; average cotton product per acre, 0.37 bale, 528 pounds seed-cotton, or 176 pounds cotton lint.

The northwestern part of Shelby county is formed by the Coal Measures of the Cahaba field; the central belt by those of the Coosa field. Between the two is the Cahaba valley, and east of the Coosa field is the valley of the Coosa. The eastern edge of the Cahaba field as far south as Helena has a northeastern and southwestern direction, but below that it turns southward to Montevallo, and thence westward to the line of Bibb county. These Coal Measures have the usual rugged surface and sandy and not very fertile soils which are always found in such regions. The whole area is drained by the Cahaba river, which flows southwest the entire length of the county. Tributaries of the Little Cahaba drain the southern edge of this field in the vicinity of Montevallo. The direction of the main streams in this region has determined the topography. The principal ridges, with their dividing valleys, have a general northeastern and southwestern trend. The Cahaba valley, which is on an average 4 or 5 miles wide, has the usual features of the narrow valleys of central Alabama. It is fluted by a number of ridges with intervening

depressions running parallel with its length. A flint ridge, with gray, gravelly soil, and with oak and pine timber, commonly occupies the central portion of the valley, and red-ore ridges, with oak timber and red sandy loam and gravelly soils, lie near the two margins. On the eastern side the red-ore ridge is more or less prominent throughout the length of the county; but on the west it is often wanting altogether, in which respect this valley differs from those lying to the north and west. The subordinated valleys lying between these ridges are based on limestones, which are of varying degrees of purity, and hence the great variety in their soils as to composition and fertility. The two principal varieties are the yellowish loamy soil with red clayey subsoil and the gray soil with subsoil filled with angular fragments of flint. The analyses given on page 22 of soils from the valley near Ashville, in Saint Clair county, show the character of similar soils in this county. In the lower part of the valley, near Montevallo, there is a great development of deep-red soils, derived from the lower limestones of the valley formation. These are in composition and derivation similar to the red valley soils, of which an analysis has been given under Calhoun county (page 22). The flinty or cherty portions of the limestone near Montevallo lie often upon the surface in huge masses of most irregular shape, and where this chert prevails the soil is poor and long-leaf pine abundant. In the same region is another class of soils derived from gray, greenish, and chocolate-colored shales, of which, however, no chemical examination has yet been made.

The soils and other characters of the Coosa coal-field are, in the main, similar to those of the Cahaba field, but the center of the former field is occupied by a narrow belt of limestones yielding very good yellowish or mahogany soils, like those of Dry valley, in Cherokee county. This limestone belt is a peculiar feature of the Coosa field. The lands of the Coosa valley are, in general terms, like those above named. There is, however, a prevalence of gray cherty or flinty soils near the river which support a magnificent growth of long-leaf pine. South and southwest of Columbiana this pine growth reaches great proportions, and has furnished for many years the fuel of the Shelby furnaces.

In the southern part of the county, below the latitude of Helena, the underlying formations are in many places more or less hidden by the beds of sand, loam, and pebbles of a later period, and the surface soils are in such cases derived from these overlying beds. The best of these soils is a brown loam, which characterizes the oak upland region of all the lower part of the state, and has been mentioned in some detail in many places. About Columbiana the prevailing soil is a yellowish or buff-colored loam, which lies in good position, and is generally under cultivation. Northeast of that town is a small mountain, which incloses some coves of good farming land. The mountain itself is high, steep, and rocky.

While Shelby belongs to the agricultural division of the Coosa valley, it partakes also of the character of the gravelly hills; hence, while we find a larger percentage of the tilled lands in cotton, the product per acre is less. The soils of the latter division, though probably intrinsically poorer as a rule than those of the valley region, are yet perhaps better suited to cotton than to other crops; hence a larger proportion of the former.

ABSTRACT OF THE REPORT OF T. A. HUSTON, OF WILSONVILLE.

(This report refers to the drainage area of Yellow Leaf creek and the immediate valley of the Coosa river.)

The best cotton land is found on the easy rolling slopes in patches varying in size from 1 to 5 acres. In the flats the plant does not mature its entire crop in time to escape killing frosts unless highly stimulated with fertilizers; otherwise, the heavy gray lands with a yellow-clay subsoil would be our best cotton lands. (This kind of subsoil does not retain manures well.) The most important cotton soil is a sandy loam resting on a red-clay subsoil, which makes perhaps one tillable acre in every six. Its timber consists of oaks, hickory, pine, chestnut, and mulberry. The top soil is a coarse, sandy, and gravelly loam of a light color, about 4 inches in thickness, with a subsoil of red compact clay, stoutly resisting the plow, hardening when exposed to the sun, and an excellent retainer of all manures. It contains angular fragments of flint, and this material often lies at the surface as large rocks. At 8 to 40 feet depth is found the flinty limestone of the country. The other principal soil variety has been mentioned above. It is a heavy gray soil with yellowish-clay subsoil, but for reasons given it is not cultivated in cotton.

Lands are difficult to till in wet seasons. The chief crops are cotton, corn, wheat, oats, sorghum, and potatoes, but the soil is best adapted to corn and oats. About one-third of the land is planted in cotton, which usually grows to a height of 3 feet. Late planting or wet weather will cause excessive growth of weed, which can be prevented by shallow plowing. Fresh land produces 450 pounds per acre, and 1,485 pounds will make a 475-pound bale. After five years' cultivation, without manure, the yield per acre is 500 pounds with liberal culture and favorable seasons, and of this it requires only 1,425 pounds to the 475-pound bale. Generally the older the land (if well cultivated) the better the staple. Perhaps one-third of the land originally cultivated is now turned out; but such lands taken again into cultivation generally surpass the fresh lands. The soil on the hillsides is washed to a serious extent, and the valleys are sometimes rendered worthless by the washings of the uplands. The damage is checked to some extent by hillside ditching.

Cotton is shipped, as soon as ready for the market, by the railroad. Selma is the usual port, the freight to that point being $1 per bale.

CHILTON.

(See "Gravelly pine-hills region".)

BIBB.

(See "Gravelly pine-hills region".)

TUSCALOOSA.

(See "Gravelly pine-hills regions".)

JEFFERSON.

(See "Coal-Measures region".)

BLOUNT.

(See "Coal-Measures region".)

MARSHALL.

(See "Coal-Measures region".)

JACKSON.

(See "Tennessee valley region".)

DE KALB.

(See "Coal-Measures region".)

COAL-MEASURES REGION.

Comprising the whole or a part of Jackson,* De Kalb, Cherokee,* Calhoun,* Etowah,* Marshall, Madison,* Morgan,* Cullman, Blount, Saint Clair,* Shelby,* Jefferson, Walker, Winston, Lawrence,* Franklin,* Marion,* Lamar,* Fayette,* Tuscaloosa,* and Bibb* counties.

JACKSON.

(See "Tennessee valley region".)

DE KALB.

Population: 12,675.—White, 11,993; colored, 682.

Area: 740 square miles.—Woodland, all. Wills' valley, 250 square miles; Coal Measures, 490 square miles (on Lookout mountain, 100 square miles; on Sand mountain, 390 square miles).

Tilled land: 52,096 acres.—Area planted in cotton, 7,469 acres; in corn, 23,929 acres; in oats, 5,113 acres; in wheat, 6,846 acres; in rye, 383 acres; in tobacco, 19 acres; in sweet potatoes, 218 acres.

Cotton production: 2,859 bales; average cotton product per acre, 0.38 bale, 543 pounds seed-cotton, or 181 pounds cotton lint.

The greater part of De Kalb county is occupied by the plateau of Sand mountain, a high plain, whose surface rocks are the sandstones and conglomerates of the Coal Measures. The eastern boundary of the county runs northeast and southwest near the crest of the plateau of Lookout mountain, which is in all respects the counterpart of Sand mountain. The two are separated by Wills' valley, which extends through the county from northeast to southwest near its southeastern border. The highest points of the two mountains are along the edges of the valley which they inclose, and the slopes overlooking the valley are usually very steep, sometimes high cliffs, continuous for many miles, and almost insurmountable. Upon the mountain-tops the land slopes gently away from the rims next the valley. Little river and its tributaries drain the Lookout mountain plateau and Town creek that of Sand mountain. Upon the former, near Valley Head, are the beautiful falls of Little river, over 90 feet in height, with a deep rocky gorge below the falls.

The mountain soils are somewhat sandy, of a gray to yellowish color, and the timber consists of the usual upland oaks, with hickory, and, in places, short-leaf pine. Their cultivation is of comparatively recent date, the first settlers preferring the valley lands, which were originally more fertile. As the valley lands have become worn the mountains have been brought under cultivation, and there are now many considerable farms both upon Sand and Lookout mountains. Upon these plateaus fruit trees seem to thrive, and the crop is rarely killed or injured by frosts. Cotton also is here successfully cultivated with the aid of moderate quantities of fertilizers. The analysis of a soil collected on Sand mountain near Valley Head will show the chemical constitution of the average soil of these plateaus (see page 27).

The valley above spoken of is about 6 miles in width, and is in reality a complex trough, made up of four more or less well-defined smaller valleys, separated by three flinty or cherty ridges. At the foot of the mountains on both sides of the valley are narrow valleys, whose soils are yellowish loams of very good quality, resembling in character the soils of Dry valley, in Cherokee county, of which an analysis is presented on page 25. The other sides of these narrow valleys are bounded by red-ore chert ridges, in which have been found in several places beds of fire-clay of exceptionally good quality, and the working of these deposits gives employment to many. The center of the great valley is occupied by a more or less continuous ridge of chert, on each side of which are small valleys based upon the magnesian limestones.

Taken as a whole, the valley soils may be classed under three heads: the yellowish or mulatto loams of the valleys proper and sandy and cherty soils of the ridges. The character of the first has already been indicated.

The cherty soils vary considerably. The colors are gray to yellow, and the average composition would be near that of the barrens soils of northern Alabama. Where the slopes are not too steep and the surface not too much broken these soils are successfully cultivated. The small chert ridges which lie nearest to the foot of the mountains have, as a rule, on one side sandy and on the other flinty or cherty soils. These ridges are, however, usually so steep

that they are seldom much in cultivation, except near the foot. An analysis of soil from Red mountain, in Saint Clair county, has been given on page 24, which will show the general character of these soils. They are nowhere considered good cotton soils, being mostly devoted to wheat and other grain.

At Valley Head is the water-parting between the Tennessee and the Coosa drainages, the former by Lookout creek and its tributaries, the latter by Big and Little Wills' creeks. The latter flows near the foot of Lookout mountain, the former near the center of the main valley.

De Kalb county is occupied in great part by the two plateaus of Sand and Lookout mountains, upon neither of which is cotton cultivated to any great extent. Cotton culture is mostly confined to Wills' valley; hence the comparativly small percentage of tilled land in cotton, though the high product per acre attests the superiority of the soils selected for this crop. Cullman and Blount counties present similar conditions.

CHEROKEE.

(See "Coosa valley region".)

CALHOUN.

(See "Coosa valley region".)

ETOWAH.

(See "Coosa valley region".)

MARSHALL.

Population: 14,585.—White, 13,084; colored, 1,501.

Area: 560 square miles.—Woodland, all. Coal Measures, 375 square miles (253 square miles on Sand mountain; 140 square miles on the mountain spurs northwest of the valleys); valley of Tennessee, 185 square miles (40 square miles in Brown's and Gunter's valleys, south of the river; 50 square miles in Tennessee valley north of Guntersville; 95 square miles coves and slopes of the mountain spurs).

Tilled land: 68,175 acres.—Area planted in cotton, 16,412 acres; in corn, 27,113 acres; in oats, 3,471 acres; in wheat, 5,797 acres; in rye, 150 acres; in tobacco, 48 acres; in sugar-cane, 51 acres; in sweet potatoes, 243 acres.

Cotton production: 5,358 bales; average cotton product per acre, 0.33 bale, 471 pounds seed-cotton, or 157 pounds cotton lint.

Marshall county is divided about equally by a valley which traverses it from northeast to southwest. This valley is a trough cut down through the Coal Measures into the limestones and other rocks of underlying formations. The Tennessee river flows down it as far as Guntersville, at which point it turns northwest, cutting through the rim of the Coal Measures which bounds the valley on that side. Below Guntersville the valley extends through Marshall and Blount counties, under the name of Brown's valley. The valley is a complex one, being made up of at least three smaller valleys, separated by ridges of flint or chert, which are parallel to each other. These subordinated valleys have red or brown loam soils based upon limestone, and are in general characters similar to the red soils of the great valley of the Tennessee.

The valley lands are level or slightly rolling, and have been generally cultivated. Big springs and lime-sinks are numerous and characteristic throughout the whole region. The dividing ridges above mentioned have mostly light-gray soils with reddish or yellowish subsoils, containing angular fragments of chert. The ridge lands are of varying degrees of fertility, supporting a timber growth which often indicates no mean soil, but the steepness of the slopes generally prevents their being brought into cultivation.

The valley rim on the eastern side is nearly continuous, but is indented here and there with gaps cut by the creeks which flow down from the elevated land on that side. This table-land or plateau of Raccoon mountain is an elevated, shallow trough, highest at its edges adjacent to this valley on the one side, and to Wills' valley, in De Kalb county, on the other side. The rim on the other side of the valley, below Guntersville, is similarly high and abrupt, but in the northwestern quarter of the county the rim has lost by erosion much of its original height, and its table-land character has in great measure disappeared. Upon all these highlands there is a capping of sandstones and conglomerates of the Coal Measures, and the resulting soils are of the kind described under De Kalb and Jackson counties, where the same formations are found.

Marshall county has a comparatively large proportion of valley lands suited to cotton culture. The sandy lands of the Coal Measures have not yet been extensively planted in this crop, although with fertilizers they yield well.

MADISON.

(See "Tennessee valley region".)

MORGAN.

(See "Tennessee valley region".)

CULLMAN.

Population: 6,355.—White, 6,312; colored, 43.

Area: 590 square miles.—Woodland, all. All Coal Measures.

Tilled land: 20,527 acres.—Area planted in cotton, 1,469 acres; in corn, 10,343 acres; in oats, 1,179 acres; in wheat, 2,569 acres; in rye, 480 acres; in sugar-cane, 66 acres; in tobacco, 41 acres; in sweet potatoes, 215 acres.

Cotton production: 378 bales; average cotton product per acre, 0.26 bale, 372 pounds seed-cotton, or 124 pounds cotton lint.

Cullman county is situated upon what has been termed the plateau, which is the southern prolongation of the Cumberland table-land. The southeastern boundary of the county is partly formed by Brown's valley, or rather by the high rim of the valley. This high level land extends thence north and northwest to the southern limit of the great valley of the Tennessee, in Morgan county. The table-land is drained partly into the Tennessee and partly into the Warrior river, the line separating the two systems of drainage being near the northern boundary of this county. The South and North Alabama railroad traverses the county, and the following altitudes will show the average elevation: Phelan, 692 feet; Cullman, 802; Milner, 840; Willhite's, 608 feet above tide. Blount Springs, which is in the valley on the one side, and Decatur on the other side of the county, have the altitudes of 434 and 577 feet, respectively. Geologically, this county is formed of the Coal Measures, and mostly of the lower strata of the same, for the limestones of the sub-Carboniferous formation are exposed above the drainage level in the valleys on each side of the table-land on which Cullman county is situated. The stratified drift, which plays so important a part both in the geological structure and in the soil formation of the counties west of Cullman, is here almost wanting. The soils of Cullman are derived almost exclusively from the disintegration of the strata of the Coal Measures, and vary according as these are sandstones and conglomerates or shales.

Cotton is a subordinate crop in all this region, yet experience has recently shown that these light sandy soils with good stiff subsoils respond well to fertilizers and yield very fair crops with a moderate outlay for manures. It is probable that a larger proportion of these lands is now planted in cotton than ever before.

ABSTRACT OF THE REPORT OF WILLIAM J. DUNN, OF CULLMAN.

(This report refers to the hilly, rolling, and table-lands lying along the headwaters of the Warrior river.)

This whole region is interspersed with many small streams, all tributary to the Warrior. These streams have very little first-bottom lands, and the whole area is much varied with spots of good and poor land. Warm weather, with occasional moderate rains, is much the best for growing crops, and for cotton culture the fair uplands are preferred to the low or wet lands. The most important soil is a light sandy loam, which makes about 90 per cent. of the county. Of much less importance are the dark sandy loams and the sandy bottoms. The growth upon the uplands consists of post and red oaks, short-leaf pine, chestnut oak, hickory, maple, dogwood, etc. The soil is usually a sandy or gravelly loam, sometimes a heavier clayey loam, of gray to brown colors, and averages 4 inches in thickness; the subsoil is rather heavier, being a reddish clay mixed with gravel, hard when dry, and underlaid with slate in some places and sandstone in others. Land is easily cultivated in wet and dry seasons alike, and rarely needs draining. The crops produced are cotton, corn, wheat, oats, rye, tobacco, sorghum, and millet. The soil is very well adapted to all these crops, and is specially good for growing grapes, peaches, and apples. Only about one-fifth of the land is planted in cotton, which usually grows not more than 3 feet high. Cotton generally runs to weed on lowlands in wet seasons. The seed-cotton product per acre is about 800 pounds, and 1,545 pounds are required for a 475-pound bale. 'After five years' cultivation, without fertilizers, the production does not amount to more than 500 pounds per acre. Crab-grass is more troublesome in wet seasons than all other weeds and grasses combined. A rest of two years to "turned out" lands is beneficial, but longer rest permits the land to grow up in bushes and sedge-grass.

Shipments of cotton are made from November to March, by railroad, to Montgomery, Nashville, and Louisville.

BLOUNT.

Population: 15,369.—White, 14,210; colored, 1,159.

Area: 700 square miles.—Woodland, all. Coal Measures, 460 square miles; valley lands, 240 square miles (Brown's valley, 170 square miles; Murphree's valley, 70 square miles).

Tilled land: 68,860 acres.—Area planted in cotton, 12,502 acres; in corn, 29,161 acres; in oats, 4,551 acres; in wheat, 10,087 acres; in tobacco, 48 acres; in sweet potatoes, 371 acres.

Cotton production: 4,442 bales; average cotton product per acre, 0.36 bale, 513 pounds seed-cotton, or 171 pounds cotton lint.

The central part of Blount county is formed by the high plateau of Raccoon mountain, which occupies a belt from 8 to 10 miles in width, running from northeast to southwest through the county. On the northwestern side of this plateau is Brown's valley; on the southeast, Murphree's valley. Raccoon mountain faces these valleys with a more or less continuous line of cliffs elevated several hundred feet above the general level, the height, as a rule, diminishing coming southward. The highest parts of the mountain lie along the edges of these valleys, the central part of its plateau being a pretty well defined basin, down which flows one of the main branches of the Black Warrior river. Near this stream the level is somewhat lower than that of the two valleys. The whole of this mountain basin has the sandstones and other beds of the Coal Measures for surface rocks, and the soils derived from them are the usual light-yellowish sandy loams, whose average composition is fairly shown by the analysis of a soil from De Kalb county (see page 27). The timber is composed of the species of upland oaks, with hickory and some short-leaf pine. These lands have lately been much esteemed as cotton lands, the use of moderate quantities of fertilizers insuring a good return, and in many places better and more profitable crops have been raised upon this land than upon the intrinsically more fertile valley lands. As pastures and for the cultivation of fruit, particularly of peaches and apples, this region is equal to any in the state. The fruit crop is rarely, if ever, cut off by frosts.

The valleys above mentioned are two deep troughs cut down by denudation into the lower rocks of the geological series. From the circumstance that these valleys have been worn down from the crest of a fold in the strata, the central parts of the same, while much lower than the mountain rims, are often higher than the country a short distance back from the rim. It thus often happens that the water rising in the valleys makes its way through these rims into the basin of Coal Measures, of which they are a part.

Brown's valley, on the northwest, is in reality for most of its length a double valley, Brown's being the western and Gunter's, or Big Spring Creek valley, the eastern. The two are separated by a flint or chert ridge, made up in great part by the siliceous fragments of the sub-Carboniferous limestones. The eastern, or Gunter's valley, has for its basis the limestones of this age, and the soils are the red and brown loams so prevalent in the great valley of the Tennessee. In the upper part of this valley, near the water-parting between the

Tennessee and the Warrior rivers, there is a great development of the sandy strata of the same formation (the rock which caps the Little mountains in Franklin and Lawrence counties), and the soils are gray or light-yellow sandy loams, timbered with oak, hickory, and short-leaf pine. In Brown's valley the calcareous rocks of a much lower geological formation appear at the surface, but the derived soils are yellowish clayey loam, not materially different from those of the other valley.

Between this valley and the rim of Coal Measures which forms a part of Sand mountain intervenes a ridge of the sandstone just spoken of, and at the western slope of this ridge, and at the foot of Sand mountain, there is a narrow valley of the same limestone, which underlies the eastern or Gunter's valley. The soil varieties, therefore, occurring in this complex valley are numerous, but are essentially of three kinds, viz: the red or brown calcareous loams of the valleys proper, resting on limestones; the flinty or cherty soils of the flint ridges before named, which are closely related to the soils of the barrens of the region north of the Tennessee river; and, lastly, the sandy soils prevailing on the water-parting previously mentioned. These do not differ materially from the soils of Sand and Raccoon mountains. In the lower part of the valley the flint ridges above mentioned reach a great height, as may be seen from the following list of elevations above tide: Blountsville, 807 feet; Wooten's peak, 1,200 feet; another peak (not named), 1,400 feet. Near the lower end of the valley are situated the well-known Blount springs, and to the northwest there is a narrow strip of Sand mountain belonging to this county, as the line follows the Warrior river.

Murphree's valley, on the eastern border of the county, is in many respects similar to that just described. In both the rocks of a geological formation much older than that of the Coal Measures appear at the surface and form the soils. Both are higher than the basins on each side, though the rims of these basins, which form the borders of the valleys, are several hundred feet higher than the valley lands. Murphree's is also a complex valley, being divided by ridges running parallel with its longest dimensions. These dividing ridges are mostly cherty or flinty, and the little valleys between have the reddish calcareous loamy soils which characterize the other valleys. Much of the gray flinty-ridge soils, especially where the lands lie well and are not too hilly, produce very fair crops, though they are not generally so much esteemed as the so-called red-clay soils.

The southeastern corner of Blount is occupied by a mountain plateau, similar to that making up the central belt of the county, and upon the eastern edge of this mountain runs the boundary-line toward Saint Clair.

Cotton culture in Blount county is chiefly confined to the valley lands; hence the small percentage of the tilled lands in this crop and the comparatively high product per acre.

ABSTRACT OF THE REPORT OF GEORGE D. SHELTON, OF BROOKSVILLE.

(This report refers to the lands drained by Big Springs creek, in the eastern or Gunter's valley.)

The soils described are, first, the loamy valley soil, which extends up and down the valley its whole length. Its timber is beech, walnut, poplar, sycamore, etc. The top soil is a sandy, gravelly, or clayey loam of gray, yellow, brown, and red colors, according to locality, thickness from 6 to 12 inches, and subsoil a thick loam, becoming under cultivation like the top soil. The subsoil usually contains angular flinty pebbles, and is underlaid at from 3 to 8 feet by limestone. This is the most important soil of this region. Subordinated to it are, second, the dark gray or mulatto lands, and third, the gravelly, sandy, and crawfishy lands, both based on sandstone rock. The dark-gray lands have a timber of post and Spanish oaks, hickory, pine, and black gum. Its subsoil is much of the same description. The gravelly sandy lands are timbered with short-leaf pine, maple, chestnut, and sweet gum. The color is whitish to gray; the thickness, 1 or 2 inches only; the subsoil is also light colored. This soil is better adapted to oats and rye, and is very little used in cotton planting.

Tillage is a little difficult in wet weather. The crops are cotton, corn, wheat, etc., but the soil is best adapted to corn and wheat. Only about one-fourth of the land is planted in cotton, which grows from 2 to 3 feet high, and runs to weed on fresh land in wet weather; but this can be prevented by topping at the proper time. The usual yield per acre is from 600 to 800 pounds, and it requires 1,160 pounds for a 475-pound bale. After five years' culture, without manure, the yield per acre will be from 500 to 600 pounds, and it requires 1,545 pounds of seed-cotton for a 475-pound bale. The staple from such land is better than that from fresh land. The principal nuisances are Spanish needles and crab-grass. No land is turned out. The soil does not generally wash or gully on the slopes or hillsides.

Shipments of cotton are made, mostly in December, by rail to Selma and Nashville, at the rate of $5 per bale.

SAINT CLAIR.

(See "Coosa valley region".)

SHELBY.

(See "Coosa valley region".)

JEFFERSON.

Population: 23,272.—White, 18,219; colored, 5,053.

Area: 960 square miles.—Woodland, all. Coal Measures, 760 square miles (Warrior field, 630 square miles; Cahaba field, 130 square miles); valley lands (Roup's and Jones' valleys), 200 square miles.

Tilled land: 71,959 acres.—Area planted in cotton, 14,220 acres; in corn, 30,928 acres; in oats, 4,708 acres; in wheat, 10,589 acres; in rye, 83 acres; in tobacco, 55 acres; in sweet potatoes, 504 acres.

Cotton production: 5,333 bales; average cotton product per acre, 0.38 bale, 543 pounds seed-cotton, or 181 pounds cotton lint.

Jefferson county is divided into two unequal parts by a long narrow valley which traverses it from northeast to southwest. Northwest of this valley, and forming nearly two-thirds of the area of the county, are the Coal Measures of the great Warrior field, and southeast the Coal Measures of the Cahaba field. In their natural features the Coal Measures are everywhere more or less alike, usually hilly and broken, and with soils, in the main, sandy

and of medium fertility, varying in quality with the underlying rock from which they are derived, which may be shale, sandstone, or conglomerate. The timber varies from that of fair oak uplands to piny woods. The scenery is usually much more varied than either the soils or the natural growth.

In striking contrast to these rugged hills is the valley, which is a deep trough and not a simple depression, but fluted with ridges and hollows, which run parallel with its length. The lower part of this trough goes by the name of Roup's, and the upper part is called Jones' valley. It varies in width from 4 to 10 or 12 miles, but where widest, in the northern part of the county, it is in reality doubled by the confluence of two valleys. The floor of this valley is higher than the general level of the country on each side, and all the creeks rising in it sooner or later break through its mountain rims and flow off into the rugged region beyond. Close to the rim of Coal Measures, on each side of the valley, there is a ridge containing red iron ore which rises to the proportions almost of a mountain, first on one side and then on the other of the valley, being rarely of equal height on opposite sides. Between these ridges and the rim intervenes a narrow valley with very fair soils.

Between the two red-ore ridges lies the main body of the valley, which is, in its entire length, divided by one (sometimes two) flint ridges, as they are called, made up mostly of angular fragments of chert, the remnants of the impure siliceous limestone which forms the basis of the valley. In places the flint ridge attains very considerable height, and is usually covered with a growth of post, black-jack, and other upland oaks. The hollows between the ridges are of various qualities—sometimes flat and glady, overgrown with cedars, and not in cultivation because of the proximity of the limestone to the surface; sometimes gently undulating, and covered with a yellow or mulatto soil, which produces well all the common crops. These latter are the typical valley lands. Along the slopes of the ridges, and occasionally making up nearly the entire valley, are somewhat broken lands with gray soil and buff subsoil, filled with angular fragments of flint or chert. These varieties all depend upon the varying quality of the siliceous magnesian limestone which usually underlies the central parts of the valley.

In addition to the above, there is in places a cold yellowish flatwoods soil, which, because of defective drainage and other physical properties, is seldom in cultivation. Between old Jonesboro' and the railroad station and southward the flint ridge becomes a very prominent feature, as it passes into a sandstone or conglomerate and widens out into a series of rugged hills several miles in width, timbered with long-leaf pine, and wholly uninhabited. These Salem hills extend from the Jonesboro' station southward about 6 miles. The two valleys, separated by the flint ridge, have often distinct names. 'Possum valley lies west of the ridge and Jones' valley east of the same. In several places the red-ore ridge is duplicated on one side of the valley, thus producing additional complications and a greater variety in the valley lands. McAshan mountain is the name given to one of these duplicated red ridges, which is 10 or 15 miles long on the western side of the valley between Jonesboro' and Tannehill. Northeast of Birmingham the valley widens out and eventually divides, one fork taking the name of Murphree's valley, the other continuing as Jones' valley, the former mostly in Blount county. The two are separated by a point of the Coal Measures called Blount mountain.

The red-ore ridge which follows the edge of Blount mountain southwest of the point of that mountain breaks up in a series of high knobs, which have the general name of Cedar mountains, from the circumstance that the limestone forming the great mass of the hills makes the surface and is covered with a dense growth of cedars. Occasionally, where the red ore and its accompanying sandstones form the summit of the hills, they have received the name of Button mountains, from the great abundance of the "buttons" or segments of the stems of crinoids with which they are filled. At this point of bifurcation of the valley the distance between the Cahaba coal-field on the east and the edge of Sand mountain on the west is some 10 or 15 miles. On the east, near the Cahaba field, is Jones' valley, and on the west, next to Sand mountain, the Back valley, as it is called. Between the two is the broken country before spoken of, formed by the Cedar and Button mountains, and also by the ridges of chert, which are invariably found in all these valleys. The rugged character of this part of the county is still further increased by the fact that the red-ore ridge itself is duplicated from Red Gap to the county-line, just below Springville. Between this duplicated red mountain and the similar ridges on the west, near the foot of Blount mountain, is Clayton's cove, embracing about 3 or 4 square miles, and hemmed in on all sides by red ore and flint ridges. The soil in this cove is the mulatto or red valley soil, with its accompanying gray flinty gravelly soil. It is all cleared and in cultivation, and quite thickly settled.

Between the base of Blount mountain and its red-ore ridge there is always a valley of greater or less width, according to locality, with yellowish or buff soil based on the sub-Carboniferous limestone. Its character is well shown in the analysis of the soil from Dry valley, in Cherokee county (see page 25). The slopes of the red ridges and the Cedar mountains, where not too steep and where the rocks are not too near the surface, are generally in cultivation. They are well suited to corn and wheat, but not to cotton. A soil of this kind from near Springville, in Saint Clair county, has been analyzed (see page 22).

Jefferson county has a large proportion of valley lands giving high product per acre, upon which alone in this section cotton is usually planted in any large quantity.

WALKER.

Population: 9,479.—White, 8,978; colored, 501.

Area: 880 square miles.—Woodland, all. All Coal Measures, but small areas, especially in the western part of the county, are covered with drift.

Tilled land: 46,725 acres.—Area planted in cotton, 8,743 acres; in corn, 21,838 acres; in oats, 2,579 acres; in wheat, 5,420 acres; in rye, 81 acres; in tobacco, 69 acres; in sugar-cane, 11 acres; in sweet potatoes, 325 acres.

Cotton production: 2,754 bales; average cotton product per acre, 0.31 bale, 441 pounds seed-cotton, or 147 pounds cotton lint.

In the northwestern corner of Walker county there is a high ridge capped with pebbles and sand. This ridge is a water-shed in its entire length in Winston, Walker, Fayette, and Tuscaloosa counties. From its position in Walker county, and from its general direction in other counties, it will be seen that the drainage of Walker county is toward the southeast. Near the dividing ridge spoken of the land is high and gently undulating, with a soil and

subsoil derived from the materials of the stratified drift formation, which forms the surface in that part of the county. Near the mouths of the streams which flow into the Warrior river, however, denudation has produced an extremely rugged country, with high, steep hills, and deep ravines between.

Near the southern extremity of the county the two forks of the Warrior river, known as the Locust and the Mulberry forks, come together, forming the main river. A part of Walker county lies between these two branches, as the line between Walker and Jefferson counties follows the water-parting. The elevation of this ridge above the river is not far from 275 feet. Close to the river in several places there are high ridges, capped with pebbles, with an elevation of 400 feet above the river level. This is, however, rather an exceptional height, as the general elevation of the country between the streams is not much over 200 or 250 feet.

In the northeastern part of the county, adjoining Blount and Winston counties, the scenery is rugged, on account of the proximity to the surface of thick beds of hard sandstone and conglomerate, into which the streams have cut their channels. The soils vary with the formations from which they are derived, those in the western corner, being mainly derived from the drift and loam, presenting the usual characters. Over the greater part of the county, however, they are derived directly from the sandstones and other rocks of the Coal Measures, and vary with the locality. As a rule, the soils of the Coal Measures are rather sandy and not very fertile; yet there are many areas of very good farming land, especially in the bottoms and lowlands of the various streams. In the vicinity of South Lowell, 6 miles north of Jasper, occupying perhaps a township, there is an isolated patch of long-leaf pine forest.

The abstracts of the reports under Winston and Cullman counties describe soils which are similar to those of Walker.

No railroad traverses Walker county, and the long distances to which it is generally necessary to haul the cotton crop in wagons is a bar to its successful production. The yield per acre is very fair, but cotton is planted only on about 20 per cent. of the land.

WINSTON.

Population: 4,253.—White, 4,236; colored, 17.

Area: 640 square miles.—All woodland. All Coal Measures, but in the western part of the county these rocks are covered with drift.

Tilled land: 17,767 acres.—Area planted in cotton, 2,048 acres; in corn, 8,098 acres; in oats, 579 acres; in wheat, 1,967 acres; in sweet potatoes, 172 acres.

Cotton production: 568 bales; average cotton product per acre, 0.28 bale, 399 pounds seed-cotton, or 133 pounds cotton lint.

The main dividing ridge between the waters of the Warrior and Tombigbee rivers runs almost north and south through the entire length of Winston county near its western line. This (the Byler) ridge, in the northwestern part of the county, also divides the waters of the Warrior from those of the Tennessee river, flowing through Big Bear creek. The greater part of the drainage of the county, therefore, is southeast into the Warrior river, the principal streams being Blackwater creek and the Sipsey fork of the Warrior river, with its tributaries, Clear creek, Brushy fork, and Rock creek. On the western side of the Byler ridge are the sources of the Buttahatchie and New rivers, which flow into the Tombigbee, and of Big Bear creek, a tributary of the Tennessee.

Although there are in this county no ridges except those formed by denudation, there is a gradual increase in the height of the land going northward from the Warrior river, through Walker and Winston, into the southern part of Lawrence county, where the southern boundary of the Tennessee valley and the northern boundary of the Warrior coal-field is formed by Sand mountain. The summit of this mountain, where it overlooks the valley of the Tennessee, has an average elevation above the general level of the latter of 475 or 500 feet.

The face of the country throughout Winston county is generally much broken. The map will show a great number of small streams which rise in the northern and western part of the county, and which, by their confluence, form the three or four principal streams mentioned above. The sandstones and conglomerates of the Coal Measures underlie, usually at no great depth below the surface, the whole county. These harder rocks are often underlaid with softer strata of shales, and the action of running water during the rainy seasons is to wear away the softer slates, thus undermining the sandstones, which break off in large masses, forming perpendicular cliffs. The undermining, thus described, causes the formation of overhanging ledges or "rock houses", which are to be found at the head and frequently along the sides of nearly all the ravines leading down toward the water-courses. These rock houses are the localities where the rarest and most beautiful ferns flourish. The creeks and other streams of Winston county have cut their channels down through these sandstones, and often flow through deep gorges with nearly perpendicular sides. In some instances rapids and waterfalls are produced, the Clear Creek falls being the best known of these. The waters of the creek here pour over two bluffs of conglomerate, each about 30 feet in height, the two being about 300 yards apart. Below the falls the creek flows down a deep, narrow gorge. These falls rival in beauty many which in other parts of the world are annually visited by thousands of tourists.

Over the Coal Measures, in the western part of the county, are tolerable thick beds of sand, pebbles, and loam of stratified drift age, which form the soils and subsoils. In the eastern parts, however, these beds decrease in thickness, and are almost entirely wanting east of the center, where the soils are in great degree derived from the disintegration of the rocks of the Coal Measures. The soils so derived are seldom very fertile, being usually rather sandy; the shales, however, yield loamy soils, which form sometimes very fair farming lands. The ridges between the water-courses in this region are not much in cultivation, both on account of the distance to springs of water and on account of the commonly rather thin soils, and the usual growth consists of post, red, and Spanish oaks, chestnut, sour gum, and in some places short-leaf pine.

The farming lands are mostly in the lowlands and in the creek bottoms, where the soil is of greater depth and more fertile. Where the stratified drift forms the surface, there is the usual variety of soils, frequently described in other parts of this report.

ABSTRACT OF THE REPORT OF F. C. BURDICK, OF HOUSTON.

(This report refers to the region drained by Yellow creek, a tributary of Sipsey fork.)

The uplands are preferred for cotton, as it is liable to be late in the lowlands. The three principal soils described are the brown-loam upland soil, the Yellow creek second-bottom brown-loam soil, and the light, sandy bottom soils of Brush and Clear creeks. The first makes about seven-eighths of the land of the region described, and has a natural growth of red, white, and black oaks, hickory, short-leaf pine, chestnut, and poplar. It is a fine, sandy loam of a brown color of an average thickness of 20 inches, with a subsoil of yellowish clay, hard when first exposed, but mixing readily with the surface soil. In cultivation it is almost impervious when undisturbed. This subsoil rests upon hard sand-rock at depths varying from 3 to 7 feet. The brown-loam lands of Yellow creek bottom make a tenth of the region reported upon. The natural timber growth is composed of oaks, poplar, beech, holly, and occasionally spruce pine. The soil is a fine, sandy loam of mixed brownish to black colors, with a thickness of 2 feet; the subsoil is heavier, a reddish clay, hard, not mixing readily with the surface soil, and is usually free from pebbles. It is also underlaid at 8 to 12 feet depth by hard sandstone. The light, sandy loams of Brush and Clear creeks have usually a brown color and a thickness of 15 inches. The subsoil is lighter, being usually a coarse sand, containing very few white pebbles.

The chief crops are corn and cotton, the latter being best adapted to the soil. About one-fourth of the land is planted in cotton, which usually reaches the height of 3 or 4 feet. Wet, warm weather causes excessive growth of the cotton plant, but this can generally be remedied by topping the plants. The average seed-cotton product per acre is about 500 pounds, and it takes 1,425 pounds to make a 475-pound bale. The cotton produced on this land rates in the market as middling upland. After five years' culture without fertilizers the yield per acre is not more than 300 pounds, and it requires 1,545 pounds of the cotton thus produced to make a 475-pound bale. The most troublesome weeds are crab-grass and rag-weed. Land is generally benefited by being turned out.

The cotton is sold mostly at the nearest railroad station, and is never shipped by the producers.

LAWRENCE.

(See "Tennessee valley region".)

FRANKLIN.

(See "Tennessee valley region".)

MARION.

(See "Oak and hickory uplands, with short-leaf pine".)

LAMAR.

(See "Oak and hickory uplands, with short-leaf pine".)

FAYETTE.

(See "Oak and hickory uplands, with short-leaf pine".)

TUSCALOOSA.

(See "Gravelly hills, with long-leaf pine".)

BIBB.

(See "Gravelly hills, with long-leaf pine".)

TENNESSEE VALLEY REGION.

Comprising the whole or a part of the following counties: Jackson, Marshall,* Morgan, Madison, Limestone, Lauderdale, Lawrence, Colbert, and Franklin.

JACKSON.

Population: 25,114.—White, 21,074; colored, 4,040.

Area: 990 square miles.—Woodland, all. Valley lands, 500 square miles (190 square miles in immediate valley of the Tennessee; 310 square miles, coves and slopes of the mountain spurs north of the river, half of which may be red valley lands); Coal Measures table lands, 490 square miles (200 on Raccoon mountain, south of the river, and 290 square miles on the mountain spurs north of the river).

Tilled land: 123,924 acres.—Area planted in cotton, 19,685 acres; in corn, 60,285 acres; in oats, 8,241 acres; in wheat, 10,051 acres; in rye, 347 acres; in tobacco, 99 acres; in sweet potatoes, 592 acres.

Cotton production: 6,235 bales; average cotton product per acre, 0.32 bale, 456 pounds seed-cotton, or 152 pounds cotton lint.

The surface of Jackson county is probably more broken than that of any other county in the Tennessee valley in northern Alabama. The valley down which the Tennessee river flows divides the county into two parts: Raccoon

mountain on the southeast, and the spurs of the Cumberland mountains on the northwest. It has an average width of about 4 miles, the greater part of this area being north of the river, leaving only a narrow strip on the other side. This valley is based on the rocks of the Lower Silurian formation, which consist of limestones, shaly, aluminous and flinty, or siliceous. The narrow bottom of the river is usually underlaid with the Trenton limestones, which also sometimes make low bluffs along the banks. The soils derived from these beds are calcareous loams of considerable fertility. Northwest of these lowlands a series of low ridges, 1 or 2 miles in width, run parallel with the course of the river through the whole county. These ridges are made by the flinty or siliceous limestones of the Lower Silurian formation, and are covered with a light-gray soil, usually filled with angular fragments of chert, and support a growth of short-leaf pines and occasional hickories. These soils resemble very much the soils of the barrens, though derived from entirely different rocks.

South of the Tennessee, Raccoon mountain faces the river with a line of cliffs almost continuous throughout the entire length of the valley, the narrow space between the river bottom and the foot of the mountain being occupied by a ridge of the cherty fragments of the lower sub-Carboniferous formation. Between this flint ridge and the foot of the mountain there is a narrow valley of very good reddish and yellowish soils, and where this valley is wide enough and the lands somewhat level these make excellent farming lands, as might be expected from the fact that they are derived from rocks the same as those which form the basis of the red lands of the great valley of the Tennessee. Along this line of cliffs the points are few at which the mountain can be ascended, and the roads lead up by gradual slopes or tortuous zigzags cut out along the mountain side. When the top is reached there is the usual plateau, very broad in this case, extending beyond the limits of the county. The monotony of this table-land is relieved by shallow ravines and depressions, along which run the creeks and spring branches. All the streams of this plateau are shed from the higher eastern edge, in De Kalb county, and flow diagonally across the plateau and off from the mountain on the Jackson county side. Where they leave the mountain they have usually cut deep, narrow gorges, which present, especially near their heads, wild and picturesque scenes. The height of the table-land is from 1,800 to 2,000 feet above the sea and from 800 to 1,000 feet above the adjacent valleys, and the timber consists principally of the various species of upland oaks, hickories, and short-leaf pines. The soils are light-gray and yellowish sandy loams, the general composition of which may be seen from the analysis of the Sand mountain soil from near Valley Head, in De Kalb county (see page 27). While intrinsically less fertile than many of the valley soils, these are far from sterile, and are now being very generally taken into cultivation by a class of small farmers. The table-lands have long been noted for the excellent pasturage which they afford.

The edge of the Tennessee valley on the north side is very irregular, and is deeply indented by coves of nearly level fertile land, which are underlaid by the rocks which form the basis of both the red and the barren lands (the latter, however, to a very limited extent) of the counties westward. Some parts are usually also indebted to the mountain limestone formation for their soils, and in this way there are many grades of fertility in lands of these coves. The ridges separating these coves, while decreasing in height toward the river, nevertheless terminate against the river valley in a series of heights with rather abrupt slopes, called the river hills, which are intermediate in level between the valley plain and the main body of the ridges. Near the river, where denudation has produced its greatest effects, those parts of the ridges which separate the coves have in many places been cut across by side ravines, and are thus more or less completely separated from the main body of the Cumberland table-lands. The river hills are mostly of this character.

Farther back, and generally north and northwest of the line of the Memphis and Charleston railroad, it is usual to find the summit of the highlands between the water-courses continuous with that of the great Cumberland plateau of Tennessee. The lower parts of these mountain spurs are usually made up of the calcareous strata of the mountain limestone, while sandstones and conglomerates form the upper parts and the summits. A line of sandstone cliffs near the summits makes the ascent of these spurs exceedingly difficult, and in the northern part of the county it is possible to cross the ridges only by making wide detours, following the courses of the streams, ascending the plateau near their headwaters, crossing the level areas on the top, and making the descent along a parallel water-course. Upon these spurs the soil and timber are the same as those of the summit of Raccoon mountain, described above.

To recapitulate, the soil-varieties of Jackson county are embraced under the following general heads:

1. The red, brown, and black soils of the hillsides, of the level and rolling lands, and of the river and creek bottoms. The soils of this class are derived from the mountain limestone, the lower sub-Carboniferous, and the Silurian formations. They form the great body of the fertile valley lands, are mostly in a state of cultivation, and hence from an agricultural standpoint are the most important. They also rank second as to superficial extent.

2. Light-gray siliceous or flinty gravelly soils, covering some of the creek bottoms and some of the slopes near the foot of the mountains, and also forming the flinty or cherty ridges which run parallel to the river on the northwest side. These are derived from the lower beds of the sub-Carboniferous and from part of the Lower Silurian formation. They are less important than any other described.

3. The light-yellowish or gray sandy soils which cover the mountain plateaus on both sides of the river, derived from the rocks of the Coal Measures, are in superficial extent the most widely distributed, and are gradually coming under cultivation.

Jackson county, like other counties of northern Alabama which have a substratum of limestones, is noted for the great number and boldness of the springs which break up from the fissures in the limestone.

Agriculturally, Jackson resembles Madison, which adjoins it on the west, though a much smaller proportion of its cultivated land is in cotton; but, on the other hand, a much larger proportion is in grain.

ABSTRACT OF THE REPORT OF W. F. HURT, OF BELLEFONT.

(This report refers to the lands drained by Mud creek, a tributary of the Tennessee river.)

On new lands the cotton grows too long and is liable to be cut off by frost, but it can safely be planted on beech and poplar lands when not too much exhausted by cultivation. The black lands are grass and grain lands, but are not suited to cotton. The most important soils are the red lands with red-clay foundations, the gray creek soils, and the barren, gray, gravelly or flinty lands which lie above overflow. Of these only the first is described in detail.

The red lands form about two-thirds of the cultivated area, and, alternating with the gray and black soils, are found throughout the county. The native growth is black and red oaks and hickory on the uplands; poplar, beech, walnut, sweet gum, and white oak on the lower lands. The top soil is a fine sandy or gravelly loam, alternating with a heavier clay loam of brown, mahogany, and red colors, the thickness being quite variable. The subsoil is heavier, and somewhat hard until acted on by rain and air. It generally contains angular, flinty pebbles, and is underlaid at 10 to 20 feet by hard limestone rock.

Lands are generally somewhat difficult to cultivate in wet weather. The chief crops are cotton, corn, wheat, etc., and the land seems equally well adapted to all. Perhaps as much as three-eighths of all the cultivated land is planted in cotton. The average height of fully-grown cotton is about 3 feet. Excessive rains will make cotton run to weed on rich lowlands, the usual remedy for which is topping. The seed-cotton product varies from 500 to 1,500 pounds per acre, and it requires from 1,425 to 1,660 pounds for a 475-pound bale. This cotton classes as middling. Ten years' culture without manuring reduces the yield from 500 to 800 pounds per acre. The most troublesome weeds are crab-grass, rag-weed, hog-weed, and lamb's-quarter. At this date no land lies turned out, as it is all needed for cultivation. The slopes are not much injured by washings, and the washings from the uplands are beneficial to the valleys.

Shipments of cotton are made, as fast as ready, to Memphis and Nashville, at the rate of about $2 25 per bale.

MARSHALL.

(See "Coal-Measures region".)

MORGAN.

Population: 16,428.—White, 11,758; colored, 4,670.

Area: 700 square miles.—Woodland, all. Coal Measures of Sand mountain, 275 square miles; sandy lands of the Little mountains, 140 square miles; valley lands, 285 square miles (red lands, 100 square miles; coves and slopes, 185 square miles).

Tilled land: 95,584 acres.—Area planted in cotton, 18,828 acres; in corn, 35,610 square miles; in oats, 4,704 acres; in wheat, 7,005 acres; in rye, 135 acres; in tobacco, 52 acres; in sweet potatoes, 365 acres.

Cotton production: 6,133 bales; average cotton product per acre, 0.33 bale, 471 pounds seed-cotton, or 157 pounds cotton lint.

In going from the Tennessee river southward through Morgan county one would come upon four terrace-like plains, each with a rather abrupt slope toward the north and a gentle incline southward. These plains would be:

1. The river bottom, with its loose, rich, alluvial soil liable to overflow, and for this reason mostly planted in corn, though some parts are put in cotton.

2. The valley of the Tennessee, which is from 75 to 100 feet above the river level, and which is a nearly level plain with rich red or brown soils, interspersed here and there with small rocky knolls, crowned with dense groves of post oak, black-jack, and hickory. The greater part of this valley, which has the same general characters here as in Lawrence county on the west, is cleared and under cultivation, and the original timber is represented only by these remnants left on the rocky ground. The width of the valley varies greatly in different parts of the county. Thus, for instance, opposite Whitesburg, in the eastern part, it is only a mile or two from the river to the foot of the Little mountains on the south side of the valley, and down to the mouth of Flint creek the mountain in many places forms bluffs along the river bank, while near Decatur it is 6 or 8 miles wide, and in places still wider. It will not be necessary to repeat the descriptions already given of other parts of this valley in Lawrence and Colbert counties.

3. From the valley there is an abrupt ascent of 75 to 200 feet, according to location, to the summit of Little mountain, which is capped with a stratum of sandstone belonging to the upper part of the sub-Carboniferous formation. This sandstone has been mentioned somewhat at length under Lawrence and Colbert counties, where it occupies a similar position upon Little mountains. This mountain, in its entire length, owes its existence to the protection against denudation afforded by the bed of sandstone. The soils derived from this rock are sandy and not particularly fertile, as may be seen from the analysis of the soil from near La Grange, given on page 34. Occasionally, where the sandstone has been cut through by erosion, the limestone which lies below it comes to the surface, forming very limy, prairie-like soils, which are very little under cultivation on account of their droughty nature, due to the proximity of the limestone to the surface and the consequent thinness of the soil. These areas, however, make excellent pastures. A large body of this kind of land has been mentioned under Lawrence county.

4. From the summit of the Little mountains, and overlooking the Tennessee valley, there is a gradual descent, going southward, to the foot of Sand mountain, which makes the fourth terrace above spoken of. The distance across from the summit of the Little mountains to the foot of Sand mountain varies very greatly. Opposite Whitesburg these Little mountains are a mere bench on the side of Sand mountain from one-half to one mile in width, but it widens toward the west, and in the vicinity of Decatur the distance is 10 or 12 miles from the summit back to Sand mountain. The gentle slope going southward is due partly to the dip of the rocks themselves in that direction, but much more is due to erosion, since the slope is greater than the dip of the strata. In the southern part of the valley thus formed between the two mountains, and beyond the sandy slope of the Little mountains, the drainage has cut down into the calcareous rocks which underlie the sandstone of the Little mountains, and the soils produced from the disintegration of these rocks vary considerably in character, some being black, prairie-like soils, similar to that of the prairie of Lawrence county, already mentioned, and some gray and crawfishy, and not much prized. From a few miles south of Decatur, up the valley of Flint creek, there is a good deal of this level, sticky, gray land, which appears to be derived from some of the deeper-lying, shaly, calcareous strata. Along the bases of the northern slopes of the spurs of Sand mountain there is a mulatto soil of very considerable fertility.

From this description it will be seen that the valley between the two mountains, which in Lawrence county has fertile red and brown soils similar to those of the Tennessee valley, in Morgan county, is more or less sandy, except where the streams have cut their channels down into calcareous rocks. It is doubtful whether in Morgan county the streams have anywhere (except in the vicinity of the river) cut down into the strata which form the basis of the red soils of the Tennessee and Moulton valleys, and this for two reasons: Erosion has been probably less

effective eastward than westward, and the thickness of the upper sub-Carboniferous beds which overlie the strata in question is very much greater in the eastern than in the western part of the Tennessee valley. Even in the eastern part of Lawrence county the red soils begin to be replaced by the gray and limy soils previously mentioned.

The fourth terrace, as has already been stated, is formed by Sand mountain, which is a part of the great coal-field, and capped by the sandstones and other rocks of the Coal Measures, and has always an abrupt slope, and in places a cliff-like slope northward toward the valley, but is nearly level on the top. The height of this summit above the adjacent valley is from 200 to 450 or 500 feet, according to locality, the greatest height being toward the east. In Lawrence and Franklin counties the northern edge of Sand mountain is comparatively little indented, and forms the water-shed between the Warrior and the Tennessee drainages, except in the case of Big Bear creek. This is the case also in Morgan county as far as the valley of Flint creek. Eastward of that point, however, this rim is deeply indented, and its outline against the valley is formed of mountain spurs, separated by deep coves, cut far back into the mountain by the streams. These spurs, like Sand mountain, of which they are a part, are in great measure composed of the calcareous strata of the mountain limestone, which is the upper group of the sub-Carboniferous formation. Overlying these, and forming the summits both of the spurs and of the main mountain, are the sandstones of the Coal Measures. The northward slopes of these spurs, like those of the main mountain, are very steep, and are composed chiefly of limestones, timbered with fine poplar and walnut trees. At the foot of these slopes is usually a strip of half a mile or more in width with mulatto soils locally noted for their fertility. The summits and very gentle southward slopes have commonly sandy soils and a growth of scrubby oaks and short-leaf pine. The spurs which project farthest north have, as a rule, suffered most degradation, and the sandstone has in many cases altogether disappeared, leaving the limestones as surface rocks. In such cases the usual growth of pine is replaced by cedars. Two of these cedar mountains are situated a few miles southward from Somerville, one of them forming one of the boundaries of Cedar cove. In the eastern part of Morgan county one of the spurs (if it may not even be called the main body of Sand mountain) extends quite up to the Tennessee river near the mouth of Flint river, and on the opposite side a ridge, which is the continuation of it, reaches far up northward into Madison county.

It will easily be inferred from the descriptions above given that the whole of Morgan county was once formed of the Coal Measures, whose general elevation was that of Sand mountain; that these measures also formed the surface of the adjoining counties in the Tennessee valley; and that all the variety now seen in the topography, geological formations, and soils in this region has been brought about by the action of running waters, of which the Tennessee and its tributaries are the present representatives, and which have worn down the surface very unequally, leaving here a portion with nearly its original height, forming the mountains, and cutting down there another portion into channels, forming the present valleys and lowlands. The soils and productions are similar to those of the counties adjoining.

MADISON.

Population: 37,625.—White, 18,591; colored, 19,034.

Area: 810 square miles.—Woodland, all. Red valley lands, 360 square miles; barrens, 150 square miles; calcareous mountain slopes, 100 square miles; Coal Measures table-lands, 150 square miles; sandy lands on smaller mountains, 50 square miles.

Tilled land: 213,221 acres.—Area planted in cotton, 72,838 acres; in corn, 69,246 acres; in oats, 6,877 acres; in wheat, 12,578 acres; in rye, 174 acres; in sugar-cane, 58 acres; in tobacco, 224 acres; in sweet potatoes, 839 acres.

Cotton production: 20,679 bales; average cotton product per acre, 0.28 bale, 399 pounds seed-cotton, or 133 pounds cotton lint.

There are only two geological formations which take any prominent part in the structure of Madison county, the sub-Carboniferous and the Coal Measures; but the former presents three distinct phases, so that the groups of rocks which give rise to well-defined topographical features as well as soil varieties are practically four in number. The lowermost of these groups is composed of highly siliceous or flinty limestones, which, in disintegrating, produce gray, sandy, or gravelly soils of only medium fertility, called, in comparison with the soils derived from the next highest series, "barrens". The topography of this region is much varied and generally rugged.

The limestones which make the next group, though still siliceous, are much less so than those below, and yield soils which are far above the average in fertility. These soils are mostly sandy loams, colored deep-red or reddish-brown with iron, and in some localities, where more calcareous, the color is dark to nearly black, like the prairie soils of middle Alabama. By reason of the comparatively uniform composition of these rocks the surface formed by them is a level or gently undulating plain, dotted here and there with small knolls, composed of the flinty portions of the limestone, and usually covered with a dense growth of oaks and hickories. The great majority of the best farming lands of the Tennessee valley on both sides of the river are of this character.

The next two groups, consisting of the uppermost beds of the sub-Carboniferous formation (called the mountain limestone) and the Coal Measures, are usually associated together, the latter occupying the summits and the former the sides of the mountain spurs and, in some localities, the valleys between them. It has already been stated that the strata of the Coal Measures yield light sandy loams of gray to yellowish colors and of only medium fertility. The mountain limestone yields a variety of soils—black and limy, mulatto, gray, and light sandy, according to locality and circumstances. All these strata are approximately horizontal, but have a slight dip south and west.

That part of Madison county east of Huntsville is formed of the spurs of the Cumberland mountains (detached peaks, groups, and ridges), the remnants of that great table-land continuous in Tennessee, but separated here by valleys. The summits of these mountains are nearly level on top, and are formed of the sandstones of the Coal Measures, and the resulting soils are the light sandy loams before mentioned. On account of their great elevation, 600 or 700 feet above the valleys, and their pleasant climate the mountain summits are, when accessible, desirable places of summer resort, Monte Sano, near Huntsville, being the summer residence of many of the citizens of that town.

The valleys separating the mountain spurs have mostly calcareous soils, and are derived partly from the mountain limestone, as mentioned, and in the deeper valleys, and those which reach down nearest to the river,

from the same beds which make the soils of the red lands of the Tennessee valley. In the former case the soils are black and sticky, like many prairie soils, but these are not very common. Sometimes they are light gray, crawfishy, and not desirable as farming lands. The mulatto soils of this formation are much the best. As a rule, the soils over the mountain limestone are rather thin, as the rock is commonly found along mountain slopes, and, therefore, is much exposed to washing.

The southwestern part of Madison is covered principally by the red or brown soils characteristic of the great Tennessee valley, and it is, taken all in all, the most desirable portion of the county for farming. In general it is level or gently undulating, with a few isolated mountain peaks, which vary the scenery. The northwestern part of the county is occupied by the barrens. The line between these and the red lands is very sinuous, and strips of red land extend far up into the barrens along the water-sheds, in some cases reaching to the state line. On the other hand, the peculiar soils of the barrens are seen along many of the creeks much farther south than their general limit. This distribution will be sufficiently clearly shown upon the map, and the peculiarities of the three most important soils are well presented in the following abstract. Analyses of red lands, barrens, and gravelly creek bottom soils from Madison will be found on pages 31 and 33.

Madison may be taken as the banner county of the Tennessee valley in the production of cotton, both in the percentage of tilled land in cotton and in the number of bales produced. The red valley lands have mostly been long cultivated in cotton and corn, without any adequate return, which accounts for the comparatively low product per acre.

ABSTRACT OF THE REPORTS OF THOMAS B. KELLY, OF CLUTTSVILLE, COLONEL W. C. IRWIN, OF HUNTSVILLE, AND GEORGE D. NORRIS, OF NEW MARKET.

(The first of the reports subjoined refers to the lands drained by Limestone creek and its tributaries, and describes the red limestone land, the barrens, and the flint gravel lands; the second refers to the region drained by Indian and Spring creeks, near Huntsville, and describes only the red valley soil; the third relates to the drainage area of Mountain fork and Hester's creek, both tributary to Flint river. The only soil described is the red clay or limestone soil above named.)

The uplands are in most cases better suited than the bottoms to cotton culture, as the plant matures better and is less liable to injury from frosts and wet weather. In good seasons, however, the lowlands will yield a larger crop and a better quality of cotton than the highlands. The most important soil is that of the red lands, which make about nine-tenths of the cultivated land in the area embraced by the second report, and about two-thirds of the cultivated area of the other two. The prevailing timber is poplar, walnut, hickory, chestnut, black, post, red, and white oaks, ash, elm, etc. The top soil is a sandy clay loam of brown, red, and mulatto colors, sometimes nearly black. The thickness varies greatly with locality, being 1 or 2 feet deep in the lowlands. The subsoil is a red-clay loam, not impervious, becoming darker, like the top soil, under cultivation, and contains commonly angular fragments of flint or chert, underlaid at a depth of 5 to 10 feet by soft, reddish-stained limestone rock. The barrens make a third of the area under cultivation near Cluttsville, but they extend thence all through the northern part of the county. The timber is chiefly post, black, white, Spanish, and black-jack oaks. The top soil is a fine sandy loam, becoming sticky and putty-like when wet, has usually a whitish to gray color, and is on an average 8 inches thick. The subsoil is rather heavier, a yellowish-red sandy material, underlaid with a hard-pan impervious to water at 3 to 5 feet. The flinty gravel soil is of limited extent, being found only along the streams. Its natural timber is beech, poplar, sugar maple, and oaks. The character of the soil is indicated in its name; the color, whitish to gray; thickness, about 12 inches. The subsoil is heavier, and is of a yellowish to red color, and contains many fragments of flint. At 5 to 15 feet depth it is underlaid with a slaty rock.

Land is easily tilled, in dry seasons especially, the principal crops being cotton, corn, oats, etc. The soils are adapted to several crops, but cotton is the chief production, at least half of the cultivated land being planted with it. The average height to which cotton grows is 3 or 4 feet. Deep culture in wet seasons will cause it to run to weed, but this can generally be prevented by shallow culture. The seed-cotton product per acre varies from 800 to 2,000 pounds, and it requires from 1,425 to 1,660 pounds for a 475-pound bale. After ten years' culture without manure the yield varies from 600 to 1,000 pounds per acre. Rag-weed, hog-weed, yellow-dock, and blackberry bushes are most troublesome. Very little land now lies turned out. The slopes or hillsides are much injured by washings from rains. This can be prevented or checked by ditching, which is sometimes practiced with success; but the valleys are generally improved by the washings from the uplands.

The cotton is mostly sold to buyers in Huntsville and other places in the county, and very little of it is shipped by the producer. Occasionally shipments are made to Memphis, Cincinnati, and Nashville, at the rate of 1¼ to 1½ cents per pound. Shipments and sales are made from the time the crop is ready till January, or later.

LIMESTONE.

Population: 21,600.—White, 11,637; colored, 9,963.

Area: 590 square miles.—Woodland, all. Red valley lands, 175 square miles; "barrens," 415 square miles.

Tilled land: 129,477 acres.—Area planted in cotton, 44,334 acres; in corn, 44,612 acres; in oats, 4,134 acres; in wheat, 7,561 acres; in rye, 234 acres; in tobacco, 107 acres; in sweet potatoes, 417 acres.

Cotton production: 15,724 bales; average cotton product per acre, 0.35 bale, 498 pounds seed-cotton, or 166 pounds cotton lint.

Limestone county resembles Lauderdale in its geological structure, surface configuration, and soils, and much that has been said under that county will apply here. A line drawn from the middle of the eastern boundary of Limestone county to its southwestern corner will divide it into two portions, differing widely from each other. North of this line are the barrens, the extension into Alabama of the highlands of Tennessee; south of the line the lowlands of the Tennessee valley. The average height of the former above the valley lands is not less than 200 feet, but this increases going northward. The valley lands themselves are some 100 feet or more above the level of the Tennessee river. Immediately adjoining the river are the first-bottom lands, which are not above overflow. These three terraces (if they may be so called) have their distinctive features. The bottom lands proper are nearly level, and have the usual fertile sandy loam soils, which are much better suited to the production of corn than to that of cotton. The valley lands are also nearly level, or only gently undulating, with here and there a rocky knoll covered with timber. The rest of the valley, as already stated, is almost entirely cleared and under cultivation.

The rock underlying this portion of the county is a limestone of sub-Carboniferous age, more or less impregnated in places with chert or siliceous matter. As the rock disintegrates under the influence of the atmospheric agencies the indestructible flinty portions are left, forming the rocky knolls, which are not generally cultivated, but which often form the sites of the farmers' houses. The soils derived from this limestone are clay loams of red, brown, and almost black colors; and the subsoil is nearly always a heavy, red clayey loam, which assumes the characters of the top soil after cultivation. This rests upon the limestone at depths which vary with the locality, the black soils being those in which the influence of the limestone is most strongly felt. These are the true cotton lands, and yield, when fresh, from 1,000 to 1,500 pounds of seed-cotton to the acre. The timber which still remains upon the rocky knolls is composed of the various species of upland oaks, hickory, ash, gums, etc.

These rocky knolls are usually of comparatively small extent. "Nubbin" ridge, however, which seems to have a similar origin, is an exception, for it is quite high and broad, and extends from the near vicinity of the Tennessee river northward to the region of the barrens. The boundary-line between this county and Madison runs along the top of this ridge for many miles. The summit of the ridge is much less encumbered with the fragments of chert than are most of the rocky knolls of similar origin, and there are upon it many spots of fair cotton land. As a general thing, however, the soil seems to be badly worn, and old fields, gashed with gullies and grown up in briers, are more often seen than cultivated lands. On account of the fine water everywhere to be had on the ridge, its pleasant climate, and its elevation, this ridge was once to a greater degree than at present the place of residence of planters whose farms were situated in the more productive but less salubrious lowlands.

The valley lands are bounded on the north by the foot-hills of the highlands, and the line of separation is an exceedingly irregular one. The surface of this transition region is much more broken than that of the valley lands on the one side or of the barrens on the other.

In general, the barrens have the characters of a tolerably level plateau, the surface of which has been cut into deep, narrow ravines by the streams. But in this respect the western part of the county is quite different from the eastern. The tributaries of Elk river, on the west, are confined to deep and narrow gorges, and have very little first- and second-bottom lands.

In the vicinity of any of these streams, but especially of Elk river, are the river hills, which make a distinct agricultural division. The manner in which they have been formed may be explained by the following considerations: Elk river flows down a basin 3 or 4 miles in width, bordered on each side by cliffs, more or less abrupt, of the rocks which form the barrens. The river follows a winding course down this basin, impinging first against the one side and then against the other, leaving on one side only a narrow strip of bottom lands between it and the cliff. On the opposite side, however, the cliffs are some 3 miles away, and the space between them and the river has been much eroded and is now dotted with hills having steep sides, sometimes isolated, and covering an area of 25 or 30 acres, sometimes connected together by low ridges. There is very little level land on top of these hills, which are the only relics left of the land degraded by the short tributaries of the river. The soil of the hillsides is red and quite fertile, and generally in cultivation; but the hills have the disadvantage that the soil is very difficult to retain, as it is liable to be washed away by every hard rain because of the steep slopes. Such are the river hills, which are much desired as farming lands, notwithstanding the natural disadvantages to which they are subject.

In the eastern part of the county the basins of the creeks are shallower, with gently-sloping sides, and include often considerable bodies of very good land. The upper part of Elk river also has some very good tracts of second-bottom land, the river hills being, as a rule, absent in that section. The fertile areas found in these positions among the barrens are, in all probability, derived from some of the lower and more purely calcareous beds of the generally highly siliceous strata of the lowest division of the sub-Carboniferous formation. On account of a gentle dip toward the south, these lower beds, composed in the main of very impure siliceous limestones, while they form the surface rocks in all the northern half of the county, in the barrens, in the lower half, pass beneath the purer and less siliceous limestones of the upper division of the sub-Carboniferous formation which make the valley lands. This valley limestone, however, is never very thick on the northern side of the Tennessee river, at least as far eastward as Decatur; and along the river banks, and in places also along the smaller streams, the underlying rocks of the barrens are exposed in every cliff.

The line of separation of the barrens from the valley lands is, as before stated, quite irregular, for the rocks of the former along the creek basins reach far down into the valley, sometimes even to the river, while, on the other hand, the red soils of the valley may frequently be found upon the summits of the dividing ridges, reaching up into the barrens for long distances. The town of Athens stands upon one of these prolongations of the red lands, and in the northern part of the county there are a few isolated spots of this red land still left upon the higher summits.

Agriculturally, Limestone is like Madison county, except that in Limestone there is a smaller proportion of red valley land and a larger proportion of barrens. The area planted in cotton yields an average return, although the majority of the lands are much worn and have had comparatively little help from fertilizers.

ABSTRACT OF THE REPORT OF F. H. PEEBLES, OF MOORESVILLE.

(The region referred to is drained by Piny, Limestone, and Beaver Dam creeks, all tributaries of the Tennessee river.)

The two principal soil varieties described are the red-clay lands and the light, sandy bottom lands of the Tennessee, and only the red lands are mentioned in detail. These form about 90 per cent. of the area reported upon, and the natural growth is composed of ash, hickory, gum, and species of oaks. The greater part of the timber has been removed and the land brought under cultivation. The top soil is a red-clay loam, as a rule, though other colors are noticed. The average thickness is 4 inches, and the subsoil is heavier, but of the same general character with the soil. It contains, especially near the water-courses, rounded and angular pebbles of quartz and chert.

Tillage is easy, except directly after hard rains or in excessively dry seasons. The chief crops are cotton and corn, and the soil is about equally well suited to each. A little more than half of the area is put in cotton, which grows to a height of from 1 to 6 feet, being most productive at 3 feet. The plant inclines to go to weed during wet fall weather, and the only remedy suggested is topping. The seed-cotton product per acre on fresh land is from 1,000 to 1,500 pounds, and 1,780 pounds are required to make a 475-pound bale, the staple from fresh land rating as middling. After fifty years' cultivation, without manure, the yield is brought down to 300 pounds, with

about the same quality of staple, and about the same proportion between the lint and seed. The most troublesome weed is crab-grass. About one-tenth of the land originally cultivated is turned out, but when again taken into cultivation it produces very well. There is comparatively little injury from washings, either to the uplands or the valleys.

Shipments of cotton are made from October to January, both by steamer and by rail, usually to Memphis or Cincinnati, and the rate of freight is from $2 to $2 25 per bale.

LAUDERDALE.

Population: 21,035.—White, 14,173; colored, 6,862.

Area: 700 square miles.—Woodland, all. Barrens, 400 square miles; red valley lands, 200 square miles; gravelly hills, with short-leaf pine, 100 square miles.

Tilled land: 102,839 acres.—Area planted in cotton, 26,594 acres; in corn, 42,890 acres; in oats, 4,609 acres; in wheat, 8,475 acres; in rye, 262 acres; in tobacco, 105 acres; in sweet potatoes, 467 acres.

Cotton production: 9,270 bales; average cotton product per acre, 0.35 bale, 498 pounds seed-cotton, or 166 pounds cotton lint.

To present in a satisfactory manner the topography and soil distribution of Lauderdale county it will be necessary to refer to its geological structure. The entire county is immediately underlaid with the rocks of the sub-Carboniferous formation and with the lower strata of the same. These are of two sorts, the upper beds being more calcareous and the lower more flinty or siliceous, and the soils derived from them vary accordingly. All these beds have a gentle slope or dip southward, by which circumstance the lower or more siliceous beds, while forming the immediate surface in the northern part of the county, are in the vicinity of the Tennessee river at considerable depths below the surface, which is formed of the overlying more calcareous rocks. The areas where these two classes of rocks form the surface differ widely in their topography, soils, and other features.

The northern part of the county (five-sevenths), formed by the siliceous beds, is an elevated plateau, a part of the highlands of Tennessee; the southern part (two-sevenths), where the calcareous beds make the surface, is a portion of the great valley of the Tennessee.

The first of these two areas is called the highlands, or barrens, and it may be described as a high plain, much cut up by deep, long, narrow ravines, which extend north and south, and from which branch off other smaller ravines, all occupied by streams during the winter months. This area becomes more broken and rugged southward, where on the borders of the valley land it is cut up into a maze of hills and ridges, with hollows or coves between, across which—*i. e.*, east and west—it is almost impossible to construct a passable road. The broken character of the country and the formation of the deep, narrow ravines, with nearly perpendicular sides, are due to the comparatively indestructible rock which lies near the surface. The disintegration of this rock, which is a highly siliceous limestone, in places almost a flint rock, gives rise to the formation of the barrens soil, a light-gray siliceous soil, which, as compared with the valley soils, is rather poor, but, as analysis and practice both show, by no means merits the name of barrens. The characteristic timber consists of post and black-jack oaks and short-leaf pine. To these are added other trees, according to variations of the soil. Along the creeks and ravines are found the finest white and red oaks, poplars, chestnuts, etc. These lands have always considerable elevation above the sea (250 feet above the level of Tennessee river, increasing toward the north). There is comparative immunity from malarial disease, the soils are more easily worked, and the cotton matures earlier, and gives often a better staple. For these reasons the lands of the barrens are gradually being brought into cultivation. Analyses of soils of this kind from Madison county have been given (see page 31).

The second of the areas above mentioned is known as the valley of the Tennessee, and constitutes in Lauderdale county a strip of gently undulating, nearly level land about 100 feet above the river and some 4 or 5 miles wide. The line separating this from the highlands is very irregular, especially in the western part of the county. The valley soils vary from red or brown loams to a dark or nearly black calcareous loam. They are all fertile and stand cultivation well, some of them having been tilled for the past 75 years (practically without manure), and yield at the present day tolerably fair crops. The natural growth consists of the various species of oaks and hickories, but most of the best lands have long since been denuded of their native forests. The limestone, which forms the substratum of the valley lands, is, in general, somewhat siliceous, though sometimes quite pure, the less pure or more siliceous portions of the limestone, in disintegrating, giving rise to the formation of rocky knolls, which are usually covered with the original timber, and form agreeable interruptions to the otherwise somewhat monotonous scenery. On these knolls frequently stand the houses of the planters. A marked feature of the valley region which is underlaid with this limestone is the great abundance of big springs and sink-holes.

The drainage of Lauderdale county is all southward into the Tennessee river by streams which have their headwaters in the highlands of Tennessee. Some of them have cut down through the limestones of the country into the rocks of still older formations, though these take no part in the formation of the soils.

In the western part of the county the calcareous rocks above mentioned are covered with beds of varying thickness of pebbles and sand of the stratified drift formation. Where these beds form the surface, they give rise to the formation of soils of the kinds often previously described. A conglomerate or sandstone made of these materials, cemented by iron, is of frequent occurrence in this part of the county. The ridges, which have generally a more or less sandy soil, are timbered with post oaks and short-leaf pines. Some of the springs of the county have a reputation for medicinal properties, the best known of these being Bailey's springs, not far from Florence. West of the town of Florence, in the great bend of the river, is the largest body of valley land in the county. It is known as the Colbert reservation, and embraces some fine farms. The valley land is said to produce, when fresh, as much as 1,000 pounds of seed-cotton to the acre, and is excelled by few tracts in the county. The yield of the better class of barrens in seed-cotton is given at 600 pounds. From the character of the topography, the bottom lands within the region are quite narrow.

By far the greater proportion of the cotton of Lauderdale county is produced upon the red valley lands, which form a good deal less than one-half the area of the county. The product per acre is above the average, and the percentage of tilled land in cotton is also quite high.

ABSTRACT OF THE REPORT OF JAMES WILLIAM MORGAN, OF FLORENCE.

(This report refers to the valley lands and river bottom in the Colbert reservation.)

The lowland cotton is liable to rust and shed in wet seasons, and is more likely to be killed by early frosts than that planted in the higher valley lands. For these reasons very little of the bottom lands is cultivated in cotton in the region under discussion, corn being the universal crop. The valley lands proper, about 100 feet above the river level, are the cotton lands. The soil varies with the location. The timber consists of hickory, post, black, red, and black-jack oaks, poplar, dogwood, etc. The top soil is a fine sandy or gravelly loam of a yellowish-brown to orange-red color, 12 to 18 inches in thickness, resting upon a tough reddish-clay subsoil, which, when undisturbed, is quite impervious. It contains numerous angular fragments of flint or chert, remnants of the siliceous portions of the limestone rock which underlies the subsoil at a depth of 8 to 10 feet on an average.

Land is generally easily tilled in dry seasons. The chief crops are cotton, corn, wheat, oats, sorghum, and sweet potatoes, and all these crops are good under favorable surroundings. At least two-thirds of the land, however, is planted in cotton, which in very wet seasons is inclined to run to weed; but this can often be prevented by not plowing too near the plants, and by topping, though the latter is sometimes dangerous. The seed-cotton product per acre when land is fresh is from 750 to 1,000 pounds per acre. This cotton rates as good ordinary to low middling. After five years' culture without fertilizers the yield per acre is from 500 to 600 pounds, but somewhat less of this is required for a bale. Crab-grass, smart-grass, and careless weeds are most hurtful. About one-third of the land is turned out, which, when reclaimed, produces very well if not too much washed. The slopes or hillsides are sometimes seriously damaged by washings; but the valleys are sometimes injured, sometimes improved, by the washings of the uplands—depending on the character of the deposit. Circling and ditching to some extent prevent injury to hillsides from rains.

Shipments of cotton are made from November to July, usually by steamboat to Cincinnati, the freight to that point being from $1 to $1 50 per bale.

LAWRENCE.

Population: 21,392.—White, 12,642; colored, 8,750.

Area: 790 square miles.—Woodland, all. Red valley lands, 260 square miles; calcareous land along mountain slopes and in coves, 220 square miles; sandy lands of Little mountain, 150 square miles; Coal Measures, 160 square miles.

Tilled land: 138,034 acres.—Area planted in cotton, 42,803 acres; in corn, 54,643 acres; in oats, 5,691 acres; in wheat, 5,919 acres; in rye, 117 acres; in tobacco, 105 acres; in sweet potatoes, 379 acres.

Cotton production: 13,791 bales; average cotton product per acre, 0.32 bale, 456 pounds seed-cotton, or 152 pounds cotton lint.

The plateau of the Warrior coal-field terminates in the lower part of Lawrence county, in a mountain escarpment 250 or 300 feet in height overlooking the Moulton valley. This mountain forms the divide between the waters flowing into the Tennessee and those flowing into the Warrior river. Between Moulton and Courtland there is another range (called the Little mountains) running east and west. This ridge is cut by all the streams flowing north into the Tennessee, and separates the Moulton valley on the south from the Tennessee valley on the north. The county is thus divided into four belts: two with prevailing sandy soils, formed by the two mountain ridges, and two with calcareous soils, occupied by the two great valleys mentioned. The geological formations which enter into the structure of the county are the sub-Carboniferous and the Coal Measures. The rocks of the latter are found only upon the summit of Sand mountain, and therefore only in the southern part of the county, while the sub-Carboniferous rocks underlie the rest of it. The soils of Sand mountain, like those of the Coal Measures generally, are sandy loams of no great fertility, but, holding well all fertilizers, are coming much into notice lately.

The sub-Carboniferous rocks, while mainly limestones, have near the top of the series a bed of sandstone of considerable thickness and of great importance in the topography and soil formation in this and adjoining counties; for the Little mountain range owes its existence to the protection afforded by a capping of this rock against the denuding forces which carved out the two valleys which it separates. The main body of the Little mountains is made up of limestones, which are passed over in ascending the mountain from either side, and it is only the summit that is occupied by the sandstone. The soil derived from this rock is a sandy loam, an analysis of which from La Grange, Colbert county, is given on page 34, and supports the usual growth characteristic of sandy soils, viz, short-leaf pine and post and black-jack oaks. In some places the sandstone is absent over considerable areas on the summit of the mountain, and the underlying limestones make the surface, forming limy or prairie soils. A tract of this prairie land about a mile and a quarter wide and 15 miles long extends along these mountains from the western part of the county a mile or less into Franklin county. This is a level piece of land, mostly uncultivated, but thickly carpeted with grass, through the soil of which in many places the bare limestone rock protrudes. Where the soil is deep enough it is said to be well suited to the cultivation of wheat, which comes to maturity before the dry weather of the summer sets in; to other crops this land is not suited, since, on account of the proximity of the underlying rock to the surface, the soil suffers much from drought. Throughout this prairie are scattered groups of trees, which afford good shade to cattle, and thus enhance the value of the land as pasture grounds. The characteristic growth is persimmon, haw, cedar, gum, and honey-locust. Along the sides of the mountain it is not uncommon to find narrow ledges with level surface of this kind of soil.

Both the great valleys in this county have flinty limestones for a substratum, and the soils and topography are determined by these rocks. The valley in which Moulton is situated is about 5 miles wide, and extends nearly through the county, merging into the mountain lands toward the east, but being more open toward the west. The valley of the Tennessee has the same general characters, but is wider and much more uniform in its features, and is, in general, a level plain with a red sandy loam soil of great natural fertility. The greater part of this plain is under cultivation, but the cleared lands are dotted here and there with beautiful groves of hickory and oaks, which cover the rocky knolls made by the disintegration of the more siliceous portions of the valley limestone. As already stated, these knolls are often selected as building spots, and many of them are adorned with handsome houses. Toward the river the valley limestone thins out, and along the banks of that stream the siliceous rocks which underlie it are exposed in bluffs of considerable height. The general level of the great valley may be put at about 100 feet above the river. The Tennessee bottom lands are loose sandy loams, very productive, but in general better suited to the production of corn than to that of cotton.

The outline of the Little mountains against the Tennessee valley is very irregular, and is a succession of projecting mountain spurs, often with a face of nearly perpendicular cliffs, alternating with limestone coves. Near the heads of these coves are sometimes found scenes of great wildness and beauty. In all the valley the lands are much worn from continuous cultivation, without return.

ABSTRACT OF THE REPORTS OF COLONEL JAMES E. SAUNDERS AND DR. F. W. SYKES, OF TOWN CREEK.

(The region described is that drained by Town and Big Nance creeks.)

This region is less liable to be visited by the caterpillar, and is also less liable to failures of the cotton crop by reason of wet weather than are the cotton lands farther south. On account of the sandy nature of the soil the crops mature better in the Tennessee valley than in regions with a different soil. Better average crops are made here than in the rich black canebrake belt farther south. The chief soils of the valley are the level uplands, the sandy creek bottoms, and dark sandy bottom lands of the Tennessee river. Of these only the first will be described in detail. This forms nine-tenths of the cultivated lands of the valley, and was originally timbered with post oak and hickory, and some black-jack oak; later a growth of red oaks has sprung up. The top soil is a fine sandy ferruginous loam of a mahogany to reddish color, with an average thickness of 6 inches. The subsoil is heavier, being a clayey loam of a dark-red color. It bakes hard when plowed too wet; yet it crumbles readily when exposed to the rain, and holds fragments of chert, rounded and angular, and full of the impressions of fossils. The subsoil is underlaid with a limestone rock at 10 to 20 feet depth.

Lands are easily cultivated in both wet and dry seasons. The chief crops are cotton and corn, two-thirds of the land being devoted to the former. In rich soil cotton grows 5 or 6 feet high, but is generally most productive when 3 feet in height. On rich land, in wet weather, the cotton is much inclined to run to weed. The seed-cotton product per acre is about 1,200 pounds, *i. e.*, a 400-pound bale, and it rates in the market as good middling. After eight years' culture without fertilizers the yield per acre is 800 pounds; after fifteen years' culture it is 650 pounds, and 500 pounds after thirty years. It requires somewhat less seed-cotton than from fresh land to make a bale. About one-tenth of the land originally cultivated is turned out; but when reclaimed, it produces well if manured and properly cultivated. Uplands are much damaged by washings.

Shipments of cotton are made from November 1 to January 1, usually by railroad to Memphis, Nashville, and Cincinnati, at the rates of $2 15 to $2 75 per bale.

COLBERT.

Population: 16,153.—White, 9,203; colored, 6,950.

Area: 570 square miles.—Woodland, all. Gravelly hills, 250 square miles; sandy soils of the Little mountains, 170 square miles; red valley and other calcareous soils, 150 square miles.

Tilled land: 74,876 acres.—Area planted in cotton, 25,411 acres; in corn, 31,575 acres; in oats, 3,846 acres; in wheat, 1,704 acres; in rye, 69 acres; in tobacco, 34 acres; in sugar-cane, 15 acres; in sweet potatoes, 286 acres.

Cotton production: 9,012 bales; average cotton product per acre, 0.35 bale, 498 pounds seed-cotton, or 166 pounds cotton lint.

East and west through Colbert county runs a range of hills called the Little mountains, north of which lies the valley of the Tennessee and south Russell's valley. Toward Russell's valley the slopes of these hills are covered with thick beds of pebbles, but toward the Tennessee valley the mountain sinks down rather abruptly, leaving an escarpment not covered by pebbles. The Little mountains are composed entirely of the strata of the sub-Carboniferous formation, which also form the substratum of the valleys on each side. These strata are, in the main, limestones, with a bed of sandstone of considerable thickness near the top of the series. This bed of sandstone forms the summit of the Little mountains, which owes its present elevation above the valleys to the protection against the denuding forces afforded by this rock. The average height of the mountains above the valleys is some 300 or 350 feet.

All the streams of the county flow into the Tennessee, and all have their sources in the mountains south of Russell's valley, in Franklin county. In their courses toward the Tennessee they have, especially westward, cut gorges or small cañons into the sandstones which form the upper stratum of the Little mountains. After leaving the mountain, they flow through the comparatively level valley toward the river. In these mountain gorges are many scenes of wild and rugged beauty; and it is not strange that the chalybeate springs, which are so common here, have been favorite places of resort.

The soils, which have been derived from the sub-Carboniferous rocks, are of two kinds: sandy and calcareous. The former are, as a rule, found upon the summit of the Little mountains; the latter in the valleys. The general characters of the sandy soils may be learned from the analysis given of a soil from La Grange (page 34). The calcareous valley soils are of two principal sorts, according to the locality: (1.) Over most of the valley the soil is a reddish loam, with yellowish or reddish clay subsoil, and where the soil is directly upon the limestone, and much affected by it, the color is inclined to be dark to black, like highly calcareous soils of other regions. (2.) In the bottoms and lowlands generally the soils are looser and more sandy or gravelly. The valley lands are timbered with a fine growth of oaks and hickories, and make an attractive country. The sandy mountain lands are timbered chiefly with post oaks and short-leaf pines.

Pebbles and beds of stratified drift cover all the western part of the county within 8 or 10 miles of the Mississippi line, and the soils, derived altogether from these beds, are very little, if at all, affected by the underlying calcareous strata of the sub-Carboniferous formation. In all this part of the state sandstones and conglomerates are of frequent occurrence, formed by the cementing together, by hydrated oxide of iron, of the sands and pebbles of the drift. Nearly every hill or ridge has upon it a capping of this sort of rock. Pine (short-leaf) and post oak form the prevailing timber on all these gravelly and sandy lands. As previously stated, the beds of drift cover also the southern slopes of the Little mountains toward Russell's valley as far east as Frankfort. In this respect Russell's valley differs from that of the Tennessee.

Analyses of the Tennessee valley soil and of the gravelly or river hills soil have been given on pages 33 and 34, and they, together with the analysis of the mountain soil from La Grange, exhibit the characters of the principal soils of Colbert county.

Colbert differs from the other counties of the Tennessee valley, except Franklin and Lauderdale, in the circumstance that a considerable proportion of its soils is made by the drift, and they are, to a certain extent, independent of the underlying rocks of the country.

ABSTRACT OF THE REPORTS OF L. B. THORNTON, OF TUSCUMBIA, AND OF T. B. BICKLEY, OF SPRING VALLEY.

(These reports refer to the valley lands within 10 or 15 miles of Tuscumbia.)

The higher-lying lands of the valley are best suited to cotton, which in the flats or basins is liable to injury from wet seasons and early frosts. These higher lands are excellent farming lands, and there is scarcely ever a failure in the crop. As usual, wet seasons, late, cold springs, and early frosts are circumstances of climate which interfere with the growth of the plant.

The principal soil varieties are brown loam, with red-clay subsoil, and the sandy mountain soil. The former, with its many variations, forms the greater part of the Tennessee valley within the county limits; the latter is found in all the mountainous region in the southern portion of the county. The prevailing timber upon the brown-loam lands is made up of red, white, black-jack, post, and chestnut oaks, hickory, chestnut, black walnut, and gums. The soil is a clayey loam of a brown to nearly black color, 1 to 2 feet in thickness, with a subsoil of red clay, which becomes like the surface soil upon cultivation, and both soil and subsoil frequently contain angular fragments of the flinty or cherty portions of the rocks from which they are derived. The subsoil rests on limestone rock at depths varying with the locality and is porous, and all these lands are naturally well drained. The mountain lands have a growth of chestnut, post, white, and chestnut oaks, with short-leaf pine. The soil is a coarse, sandy loam of a whitish to gray color, and quite thin. The subsoil is rather heavier, and contains occasionally rounded pebbles of quartz and fragments of the underlying rock, which is a sandstone, and usually at no great depth from the surface.

Land is somewhat difficult to cultivate in wet seasons, but can be tilled early when well-drained. The principal crops are cotton, corn, wheat, oats, clover, and potatoes, and all succeed well. About one-half of the valley and one-fourth of the mountain land is planted in cotton. The usual height of the plants is from 3 to 5 feet in the valley and 2 feet on the mountain, production being most rapid just before growth is completed. In wet seasons cotton planted close in the drill is inclined to run to weed, but this can be prevented by thinning out to proper distance and by topping. On fresh land the product per acre of valley land is about 1,200 pounds of seed-cotton—800 pounds on mountain—and it requires from 1,660 to 1,780 pounds for a 475-pound bale. The cotton thus produced generally rates as good middling to good ordinary. After ten years' continuous culture in cotton the yield is only 600 to 800 pounds per acre, 400 on mountain land; but there is no change in the amount required for a bale. Crab-grass, hog-weeds, and careless weeds are most troublesome. At least one-third of the valley and one-half of the mountain land originally in cultivation is now turned out, but when restored to cultivation it generally produces about as well as fresh land. The slopes or hillsides are washed into gullies unless measures are adopted to prevent washing, but the valleys are often benefited by washing from the uplands.

Shipments of cotton are made mostly in November and December, by rail and river, chiefly to Memphis, at the rate of $2 per bale by rail and $1 50 by river. Occasionally shipments are made to other ports.

FRANKLIN.

Population: 9,155.—White, 8,079; colored, 1,076.

Area: 610 square miles.—Woodland, all. Red valley and other calcareous lands, 220 square miles; sandy soils of the Little mountains, 40 square miles; gravelly hills, 200 square miles; Coal Measures, 150 square miles, in great measure, however, covered with drift.

Tilled land: 46,895 acres.—Area planted in cotton, 10,308 acres; in corn, 21,038 acres; in oats, 3,020 acres; in wheat, 1,660 acres; in tobacco, 17 acres; in sugar-cane, 96 acres; in sweet potatoes, 137 acres.

Cotton production: 3,603 bales; average cotton product per acre, 0.35 bale, 498 pounds seed-cotton, or 166 pounds cotton lint.

The northern half of Franklin county is a valley known as Russell's valley; the southern half is high table-land, the northern edge of the Warrior coal-field. Most of the streams of this county rise at this foot of the escarpment which separates the valley from the table-land and flow northward into the Tennessee. Big Bear creek takes its rise south of this escarpment and flows at first southwestward, as though a tributary of the Tombigbee, but its course is soon changed to westward and then northwestward by an accumulation of pebbles and sand, and it breaks through this mountain escarpment into the valley and flows thence northward into the Tennessee. This pebble ridge is a noticeable feature in the topography of Franklin county. Overlying the strata of the Coal Measures, it forms an irregular crescent, beginning in the southeast of Franklin, bending down into Marion, and returning again into Franklin county near its southwestern corner. The waters north of this ridge flow into the Tennessee; south of it into the Tombigbee. The extraordinary deflection of Big Bear creek, caused by this ridge, has been mentioned under Marion county. The waters of Big Bear creek, on the north, are some 50 feet or more higher than those of the tributaries of the Tombigbee river on the south, though the two are only a few miles apart.

The geological formations concerned in the structure of Franklin county are three in number, viz: the sub-Carboniferous, the Coal Measures, and the stratified drift, and their surface distribution is in general as follows: The table-lands are formed by the second, the valley by the first, while the drift overlies both in the western part of the county, and to some extent also in other portions. To go more into detail, the northern limit of the Warrior field is an exceedingly irregular line, formed by projecting ridges, with limestone coves between. East of Russellville these mountain prongs extend northward as far as the middle of township 7, and a few project still further northward. West and southwest of Russellville the line is still less regular, and cannot well be described without the aid of a detailed map. The irregular line of mountain spurs, with interlocking coves, runs from Russellville south and southwest to near the middle of township 8, range 14 west, and thence southward into Marion county. Except near the southern line of the county the strata of the Coal Measures are found only near the summit of the mountain, and are therefore of no great thickness, the sides of the mountain, as well as the valley below, being formed of the calcareous rocks of the sub-Carboniferous formation.

The soils derived from the disintegration of the strata of the Coal Measures are, as usual, sandy and not very fertile, but the calcareous rocks above mentioned give rise to soils which are above the average in fertility. The soils of the drift have already been frequently described. The best cotton lands are found in Russell's valley, and the soil best suited to this crop is a red or mulatto-colored loam with red or yellow clay subsoil. Where the limestone reacts upon the soil, this is often of a black color, much like the black prairie soils of the lower part of the state. The deep color is due to the presence of vegetable matter and its rapid decay under the influence of the lime. The bottom lands partake, as usual, of the characters of the uplands from which they are derived, but are, as a rule, rather more sandy. In the western part of Franklin county the beds of stratified drift overlie the other

formations, and the soils are derived from the loam and other strata of this superficial covering. In the eastern part of the county the table-lands before spoken of are about 250 or 300 feet above the general level of the valley; but westward the height decreases somewhat, and the escarpment which forms the southern limit of the valley loses its importance west of Russellville, both because of the diminished height of the escarpment itself and because the beds of drift have filled up the valley.

In cotton product per acre Franklin ranks well with the Tennessee Valley counties, and its soils, both those of the red valley lands and those derived from the drift, are well suited to the production of this staple.

ABSTRACT OF THE REPORT OF DR. DANIEL N. SEVIER, OF RUSSELLVILLE.

(This report treats of the region drained by Cedar creek, a tributary of Big Bear creek.)

The uplands here referred to are in the valley, and not upon the table-land, and are hilly, with thin soil, mixed with sharp, angular fragments of flint and cherty gravel. This soil has a red or a buff clay subsoil. Either cold or wet injures the growth of cotton, causing it to die out or become lousy. Protracted wet spells cause it to shed its squares, and early frosts kill the top bolls. Hot, dry weather is best for cotton. No damage is done by the caterpillar or boll-worm in this part of the state.

The four principal soil varieties are, in the order of their importance in cotton cultivation, the red or mulatto lands, the hilly lands, with thin soils and red or buff-colored clay subsoils, the black sandy alluvial lands, and the black lime-lands. The red or mulatto lands are much the best for cotton. They form most of Russell's valley, which is from 6 to 8 miles wide, and extends from the adjoining county on the east to 7 miles west of Russellville. The prevailing timber is red, white, and black oaks, poplar, hackberry, black walnut, cherry, and hickory. The soil is a coarse sandy or gravelly loam, sometimes a heavier clay loam, of buff to brown or nearly black color. The thickness is 10 to 15 inches, and the subsoil a red or buff clay. When well plowed this soil produces good crops and stands drought well.

The hilly land produces good crops both of cotton and of corn, and other crops as long as it lasts, and rests upon a red or buff clay foundation, but washes badly into deep gullies, and the lowlands are filled up with great heaps of gravel. The black sandy alluvial lands are subject to overflow, and are well suited to corn, but not to cotton. The black lime-land is also well suited to corn, but the cotton grows too rank upon it, and is likely to take what is called the black rust. In some localities this land rests upon a bed of limestone at varying depths. These lands are alluvial in character.

The chief productions are cotton, corn, oats, and potatoes, but the soils are generally best adapted to the two crops first named. About two-thirds of the red land is planted in cotton, the plants attaining a height of from 1 to 3 feet, and usually producing more or less according to the height. Cotton often runs to weed on rich land in wet weather, but this can be checked by topping. The seed-cotton product per acre is from 800 to 1,200 pounds, and 1,545 pounds are reckoned to a 475-pound bale. Crab-grass and hog-weeds are most troublesome on this soil. The slopes are much damaged by washings, and not much effort is made to prevent or check the injury.

The cotton crop is usually hauled on wagons to Tuscumbia or some other station on the railroad, and thence shipped to Memphis or other ports by the purchasers. The freight to Tuscumbia will average perhaps $1 50 per bale. Most of the shipments are made during the autumn and winter.

OAK AND HICKORY UPLANDS, WITH SHORT-LEAF PINE.

This region includes the following counties, wholly or in part: Lauderdale,* Colbert,* Franklin,* Marion, Lamar, Fayette, Walker,* Pickens, and Tuscaloosa.*

LAUDERDALE.

(See "Valley of the Tennessee".)

COLBERT.

(See "Valley of the Tennessee".)

FRANKLIN.

(See "Valley of the Tennessee".)

MARION.

Population: 9,364.—White, 8,841; colored, 523.

Area: 810 square miles.—Woodland, all. Coal Measures, 660 square miles; gravelly pine hills, 150 square miles. (The drift makes a certain proportion of the soils and subsoils over the entire county, but on the west the underlying formations are completely hidden,)

Tilled land: 42,925 acres.—Area planted in cotton, 7,269 acres; in corn, 21,835 acres; in oats, 2,321 acres; in wheat, 3,925 acres; in tobacco, 44 acres; in sugar-cane, 15 acres; in sweet potatoes, 477 acres.

Cotton production: 2,240 bales; average cotton product per acre 0.31 bale, 441 pounds seed-cotton, or 147 pounds cotton lint.

The area drained by the Buttahatchie river and its tributaries includes the greater part of Marion county. The headwaters of this stream rise at the western foot of a ridge of sand and pebbles known as Byler ridge, which extends from Tuscaloosa county northward through Fayette, Walker, and Winston counties to the southern limit of the great valley of the Tennessee. Another ridge of similar structure, but much smaller, in the northeastern corner of the county turns the waters of Big Bear creek to the north. Most of the tributaries of the Buttahatchie river in Marion county flow southward from this ridge, as do also the tributaries of Bull Mountain creek, in the

northwestern corner of the county. The bed of Big Bear creek is considerably higher than that of the headwaters of Buttahatchie river and of Bull Mountain creek, which are distant from it only a few miles, and a comparatively short canal would suffice to turn the waters of Big Bear creek in a torrent into either of the others.

The geological structure of Marion county is in its general outline quite simple, its substratum being formed of the sandstones, shales, and conglomerates of the Coal Measures, which are covered with a capping of pebbles, sand, and other beds of the stratified drift. The general slope of the underlying beds is toward the southwest, and the thickness of the superficial deposits increases in the same direction. In the eastern part of the county even the smaller streams have cut their channels through the thin drift-covering into the underlying Coal Measures, but in the extreme west none but drift beds are exposed, even in the deepest drainage cuts.

The soils in the west are, in consequence, derived almost exclusively from the overlying drift beds, and are of the usual characters so often described. The uppermost 20 or 25 feet are usually formed of a stiff red loam, which rests upon the beds of pebbles and sand which make up the greater part of the formation. The red loam, therefore, commonly occupies the higher table-lands and the level second bottoms, where erosion has been least effective. Upon the hillsides and slopes the other beds of the drift come to the surface, and the soils derived from them are much less fertile. The surface soil of the red loam is usually a sandy loam of a brown color, from the addition of vegetable matter, and the growth upon it is that of the brown-loam uplands everywhere.

The high table-lands of Marion county furnish superior farming lands, desirable on account both of the natural fertility of the soil and of their favorable position with respect to drainage, etc. In those parts of the county where the strata of the Coal Measures are near the surface the sandstones and conglomerates form bluffs in all the ravines. Underneath the overhanging cliffs, or "rock houses", as they are locally termed, grow abundantly some of our rarest and most beautiful ferns, such as *Trichomanes radicans*, *Asplenium pinnatifidum*, *Asplenium montanum*, *Trichomanes Petersii*, etc.

Many of the upland soils, especially in the western part of the county, are quite productive, and with better facilities for shipping the crop Marion would take a fair rank among the northern counties in the production of cotton.

ABSTRACT OF THE REPORT OF MARTIN NESMITH, OF PIKEVILLE.

(This report refers to the lands drained by Beaver creek, a tributary of the Buttahatchie river.)

Two-thirds of this area is hilly, and is not in cultivation; the remaining portion table-lands and bottoms. The soils, more than the climate, influence the growing of the cotton, for in the low, wet lands the plant weeds well, but does not mature. The uplands and second bottoms, especially when well fertilized, make the best crops, and the plant matures well, the staple being both longer and better. The soil varieties described are the brown-loam lands, the black sandy lands, and the swampy or low marshy lands.

The first forms one-half or more of the cultivated lands in the region described, and is timbered with white, black, and red oaks, hickory, short-leaf pine, beech, and black and sweet gum. The soil is a dark or brown sandy loam of 5 or 6 inches in thickness, resting on a reddish clayey subsoil, which is underlaid with sand and gravel.

The black sandy lands form one-third of the cultivated lands in the region, and this soil occurs in patches of from 25 to 30 acres, alternating with flinty or gravelly lands. The natural growth is short-leaf pine, hickory, post and red oaks, and chestnut. The soil is a sandy or gravelly loam, heavier clayey loam in places, of an average thickness of 6 inches; the subsoil a tough, whitish clay, which bakes very hard, and does not pulverize under cultivation. It contains often white, rounded, and angular pebbles, and rests upon beds of sand and gravel at a depth of 3 or 4 feet.

The swamps or marshes form the third variety of land, and occupy about one-sixth of the area. The timber is composed of white oak, sweet and black gum, beech, poplar, bay, etc., and the soil is a whitish or gray clayey loam, quite thin (2 inches), with a subsoil of heavy clay. This soil, being very thin and whitish, is poor, and does not pay to cultivate.

Tillage is usually difficult only in wet seasons. The principal crops are cotton and corn, the soil being generally best adapted to the former crop. About one-half of the land is planted in cotton, which attains a height of from 2 to 5 feet. In late planting, on low wet land, the cotton plant generally runs to weed, but this can be prevented by early planting and the use of fertilizers. The yield per acre is about 400 pounds, and it generally requires 1,425 pounds of seed-cotton to a 475-pound bale. After ten years' continuous culture without manure the land will not yield more than 300 pounds per acre, and of such cotton it will take 1,545 pounds of seed-cotton to the bale. Hog-weeds, rag-weeds, and burrs are the usual farm nuisances. About one-fourth of the land originally cultivated now lies turned out; but when such land has lain idle several years it will produce good crops. There is some hillside ditching to prevent gullies, but the valleys are generally benefited by washings from the uplands.

The shipments of cotton are made in November and December, by railroad, to Mobile, at the usual rate of $1 per bale; but the fact that there is no railroad in this county tells against the production of cotton, which has often to be hauled many miles in wagons.

LAMAR.

Population: 12,142.—White, 9,967; colored, 2,175.

Area: 590 square miles.—Woodland, all. Pebbly hills, 550 square miles; Coal Measures, 40 square miles.

Tilled land: 62,141 acres.—Area planted in cotton, 15,245 acres; in corn, 28,303 acres; in oats, 4,139 acres; in wheat, 5,627 acres; in rye, 75 acres; in tobacco, 46 acres; in sweet potatoes, 626 acres.

Cotton production: 5,015 bales; average cotton product per acre, 0.33 bale, 471 pounds seed-cotton, or 157 pounds cotton lint.

Lamar county is wholly upon the belt of stratified drift which covers the line of junction of the older and newer formations in Alabama. Its surface, therefore, is formed by the sands, clays, and pebble beds of this formation and of the rocks which are produced by the cementing together, by hydrated iron oxide, of these materials. A bed of varying thickness of red loam or red clay nearly always forms the surface unless removed by denudation. The soils, consequently, vary from stiff reddish loams, becoming brown upon the addition of vegetable matter, to light sands. The natural growth varies similarly from the luxuriant timber of the oak uplands to that of the black-jack ridges, which, in addition to the oak, often support a growth of short-leaf pine.

From observations made in the adjoining counties, it seems probable that the strata of the Coal Measures underlie the beds of drift; but as yet these rocks have not been noticed. The hills separating the streams in the eastern part of the county are from 250 to 300 feet in height above the water-courses, and are composed

throughout of the materials of the drift. Pebbles are found as usual below the capping of red loam, which here, as elsewhere, forms the surface. Where thin beds of clay underlie the loam or other strata it is not unusual to find a thin layer of ferruginous sandstone or conglomerate, formed by the cementing together of the sand or pebbles by the oxide of iron which is so universally diffused through this formation as coloring matter. The somewhat hard rocks formed in this way often protect from denudation the underlying strata, and are commonly found upon the summits of the hills, which owe their existence to the protection thus afforded.

The drainage of Lamar county is southwest into the Tombigbee by the Buttahatchie river and Luxapolila creek and their tributaries. The main water-sheds are usually table-lands with brown-loam soils and reddish subsoils, such as have been described at length under Pickens and other counties. The average height above drainage of the table-lands, like that of the highest hills of the minor water-sheds, is some 250 or 300 feet.

ABSTRACT OF THE REPORT OF GEORGE E. BROWN, OF CANSLER.

(This report refers to the region drained by Beaver creek and Buttahatchie river and their tributaries.)

In the second bottoms cotton yields more to the acre than upon the uplands, but is liable to be cut off prematurely by frosts. Throughout the county the soils are more or less sandy in texture, and are timbered with short-leaf pine, the various species of oak, hickory, ash, chestnut, and sassafras. The top soil varies from light sandy to a rather stiff clay loam of whitish, yellow, red, and blackish colors, and the subsoil is usually somewhat heavier, and of a reddish to yellow color, containing pebbles in size from a buckshot up. The subsoil rests on a clay, and this on beds of pebbles and sand. The lands are easily tilled under all circumstances, and the chief crops are corn and cotton. It is thought that corn succeeds best, though the soil is well suited to each.

Nearly half of the tilled land is in cotton, which attains heights varying from 3 to 6 feet, being most productive at medium heights. The plant tends to run to weed when there is an excess of rain during its earlier stages, and no remedy is suggested. The seed-cotton product per acre of the fresh land is from 600 to 1,200 pounds, and 1,485 pounds are needed to make a 475-pound bale. The staple rates about low middling. After three or four years' cultivation without manure the yield falls off considerably. The staple from the worn land is shorter than that from the fresh, but it is good, and requires a little more of the seed-cotton to make a bale. The most troublesome weed is crab-grass and, in rich spots, cocklebur. About one-eighth of the land originally in cultivation now lies turned out. If not hilly, such land, when reclaimed, produces about as well as when fresh. The soil is of such a nature that it washes badly on slopes, though the injury from this cause is not very great. If the valleys are very narrow, they are injured by being covered with sand, but no serious efforts have been made to check this evil.

Cotton is usually hauled to Columbus and Aberdeen, Mississippi, the nearest market on a railroad.

FAYETTE.

Population: 10,135.—White, 8,873; colored, 1,262.

Area: 660 square miles.—Woodland, all. Coal Measures, 600 square miles; gravelly pine hills, 60 square miles (but the gravel and other drift beds overlying the Coal Measures to some extent over the entire county, it is only in the 60 square miles above noted that they hide completely the lower rocks).

Tilled land: 56,118 acres.—Area planted in cotton, 12,331 acres; in corn, 24,950 acres; in oats, 3,627 acres; in wheat, 4,826 acres; in rye, 46 acres; in tobacco, 37 acres; in sweet potatoes, 421 acres.

Cotton production: 4,268 bales; average cotton product per acre, 0.35 bale, 498 pounds seed-cotton, or 166 pounds cotton lint.

There are two principal systems of drainage in Fayette county: one into the Warrior river, and the other into the Tombigbee. These are divided by a sinuous ridge having a general northern and southern direction, and known as Byler ridge. Upon this ridge, for most of its length, is an old thoroughfare, the Byler road, much used in former times. The Warrior system may be still further divided; for a part of the water reaches the Warrior river southeastward through Lost, Cane, and Wolf creeks, while a greater part flows southward through the North river and its tributaries. The Tombigbee drainage is in general southward in three narrow belts not more than 5 or 6 miles wide east and west. The widest of these areas is that of the Sipsey, or New river; the next is drained by the Luxapolila, and the third by Hell's creek and Yellow creek, both tributaries of the Luxapolila. The ridges separating these areas are simple ridges of denudation, and the average height above the streams is about 250 or 300 feet.

The character and distribution of the soil varieties of Fayette county depend upon the relations of the two geological formations which enter into its structure. These are the Coal Measures and the stratified drift. The surface formation over the whole county, except in valleys excavated by the various streams, is the latter; but beneath it, at depths varying with the locality, may always be found the sandstones, shales, and other strata of the Coal Measures. West of the Luxapolila river no Coal Measures have been noticed, for the reason, probably, that the drainage has not cut deeply enough to expose these underlying beds. In the extreme eastern part of the county the soils depend in great measure upon the strata of the older formation, but in the rest of the county they depend upon the drift alone.

The most important and widely spread soil is a brown loam with red clayey-loam subsoil, with timber of post, red, and black-jack oaks, chestnut, short-leaf pine, etc., such as characterizes the oak uplands in various parts of the state. This soil is derived from red loam, which, as a rule, forms the capping over the sands and pebbles of the stratified drift. It grades off on the one hand into sandier, and on the other into more clayey varieties, with corresponding changes in the timber. There are two principal soil-varieties derived from the strata of the Coal Measures. These are the sandy soils of the sandstones and conglomerates and the clayey soils of the shales of these measures. These soils, however, do not differ essentially from the sandy and loamy soils of other origin. Soils similar to those of Fayette are described in the abstracts under Winston and Marion counties.

There being as yet no railroad through Fayette county, the cotton produced there must be hauled in wagons many miles, either to the Mobile and Ohio road, in Mississippi, or to Tuscaloosa. This lack of transportation is a serious hinderance to the production of cotton, and the small number of bales given above is due to the small acreage. The soils are above the average in fertility.

Fayette county might have been classed with the oak uplands region, since the prevailing cultivated soils are those which characterize this region.

WALKER.

(See "Coal-Measures region".)

PICKENS.

Population: 21,479.—White, 9,132; colored, 12,347.

Area: 1,000 square miles.—Woodland, all. Gravelly pine hills, 950 square miles; prairie, 50 square miles.

Tilled land: 115,560 acres.—Area planted in cotton, 52,651 acres; in corn, 43,104 acres; in oats, 8,053 acres; in wheat, 2,220 acres; in rye, 36 acres; in tobacco, 51 acres; in sugar-cane, 19 acres; in sweet potatoes, 757 acres.

Cotton production: 17,283 bales; average cotton product per acre, 0.33 bale, 471 pounds seed-cotton, or 157 pounds cotton lint.

The soils, topography, and other natural features of Pickens county are dependent almost entirely upon a single formation, the stratified drift, which makes the surface over all, except the extreme southwestern corner of the county, where the calcareous beds of the Cretaceous formation are exposed. All the drainage is into the Tombigbee river by Sipsey river and Bear, Lubbub, and Coal-fire creeks. The face of the country throughout the county is quite broken, as is always the case where the drift is the prevailing formation. This is well illustrated between Tuscaloosa and Carrollton, where the road passes over a succession of little hills, separating the drainage areas of the creeks. The prevailing timber here is a mixture of the upland oaks with short-leaf pine. With the loam soils, which prevail, there is in places a large proportion of clay coming from the drift beds, and where this material is abundant the soil is quite stiff and the post oak forms the principal tree. South of Carrollton the lowlands of Lubbub creek, 1 or 2 miles in width, form excellent farming land. The divide between this and Blubber creek is a fine table-land with brown-loam soil, timbered with the upland oaks, and very fertile.

Southwest of a line joining Pleasant ridge, in Greene county, with Pickensville the Cretaceous strata form the country, but do not in any great degree influence the soils on the northeastern side of the river; but beyond it the prairie soils of the usual character make their appearance, forming the great proportion of the lands in the southwestern corner of the county. Drinking water in this region is obtained from bored or artesian wells, as the surface water at certain seasons is both scanty in quantity and of poor quality.

The upland soils of Pickens vary from the best brown to sandy loams, and all rest upon red-clay loam, which itself is generally underlaid with sand and pebbles. The bottom and hummock lands in the greater part of the county have in general the characters of the loam uplands which adjoin them, and are in many cases of superior quality. Southwest of the river the topography is less varied than elsewhere, the country being gently undulating, with low ridges of drift to relieve the monotony. The soils in this part of the county are the usual rotten-limestone prairie soils and the varieties resulting from the intermixture of this with the surface loams of the drift.

In its agricultural features Pickens county resembles its neighbors, and presents no special peculiarities.

ABSTRACT OF THE REPORTS OF M. F. COOK, OF PICKENSVILLE, AND R. F. HENRY, OF COLUMBUS, MISSISSIPPI.

(These reports relate to the bottom and uplands of Coal-fire creek and to those of McBee creek, both streams tributary to the Tombigbee river.)

Late springs, with cold rains, sometimes cause poor stands of cotton, and late frosts kill the young plants. In the northern part of the county the uplands are generally poor from long and careless cultivation; yet the few level spots are still quite productive. The bottom lands generally produce good crops of cotton, except in a few cases where the soil is gravelly. When planted in time and properly cultivated the whole crop will generally open before killing frosts. On the uplands of the central and southern parts of the county cotton rarely fails, especially if fertilizers are applied before planting. The western part of the county is a good cotton country, and entire failures of the crop are unknown.

The most widely-spread soil in the county is the brown loam of the uplands, which varies from a rather heavy and fertile to a light sandy loam. The subsoil in most cases is a stiff, reddish clayey loam, sometimes yellow, with sand and gravel underlying at varying depths. Now and then there are patches of crawfishy soil, with whitish clay beneath. The timber of the uplands consists of pine, red, black, Spanish, and black-jack oaks, hickory, chestnut, etc., with white, water, and willow oaks, ash, cypress, beech, sweet and sour gums, and other growth in the lowlands.

The lowlands and bottom lands have generally a "made soil", which is a light loam, more or less sandy, of dark, sometimes black, colors. These also have usually a red-clay subsoil, much like the subsoil of the adjacent uplands. The soils of the bottoms are often of considerable thickness; that of the uplands varies greatly, being in places almost entirely washed off. From one-half to three-fourths of the county has a sandy soil, especially on the water-sheds, and this soil has a natural growth of pine, mixed with the several species of oaks, and with hickory where of better quality. These soils are of gray to dark colors, and sometimes a foot or more in thickness. The subsoils are also sandy, holding pebbles.

These lands are generally easy to cultivate. The chief crops are cotton, corn, oats, and potatoes, but the soil is best adapted to cotton, potatoes, and oats. More than one-half of the cultivated land is in cotton. The height to which cotton grows varies from 2 to 6 feet. Rich bottom lands, when cultivated too deep in wet seasons, make the cotton run to weed, but this can be prevented by underdrainage, shallow culture, and topping. The seed-cotton product per acre on fresh land is about 1,000 pounds, and it requires 1,545 pounds to make a 475-pound bale; but the staple is not as good as that from old, fertilized land. After two or three years' culture the yield is increased, but after five years the uplands begin to wash, and there is a falling off in the yield; but the bottom lands are as productive now as 20 years ago. Morning-glory, crab-grass, and purslane are specially troublesome. Only a small part of the uplands is turned out. Such turned-out lands will produce well if Japan clover cover them one or two years. The hillsides and slopes are somewhat injured by washings, but this may be and is prevented by ditching, underdraining, etc.

The cotton crop is largely sold to cotton buyers in the local markets. When shipped to Mobile the freight is $1 25 per bale. The shipping is by the Tombigbee river, and is usually done between November and February.

TUSCALOOSA.

(See "Gravelly pine-hills region".)

GRAVELLY HILLS, WITH LONG-LEAF PINE.

This region includes parts of Pickens,* Tuscaloosa, Greene,* Hale,* Bibb, Perry,* Chilton, Autauga, Elmore, Montgomery,* Tallapoosa,* Macon,* Lee,* and Russell.*

PICKENS.

(See "Oak and hickory uplands, with short-leaf pine".)

TUSCALOOSA.

Population: 24,957.—White, 15,216; colored, 9,741.

Area: 1,390 square miles.—Woodland, all, Four hundred square miles are pebbly pine hills (250 square miles with short-leaf pine and 150 with long-leaf pine), and, in addition to this, of the 965 square miles of the Coal Measures 675 square miles have the characters of the pebbly pine-hills, and 225 square miles have the short-leaf and 450 square miles the long-leaf pine; 25 square miles in Roup's valley.

Tilled land: 111,171 acres.—Area planted in cotton, 33,773 acres; in corn, 38,638 acres; in oats, 6,974 acres; in wheat, 2,689 acres; in rye, 130 acres; in sugar-cane, 35 acres; in tobacco, 20 acres; in sweet potatoes, 919 acres.

Cotton production: 11,137 bales; average cotton product per acre, 0.33 bale, 471 pounds seed-cotton, or 157 pounds cotton lint.

A line drawn from the northwestern to the southeastern corner of Tuscaloosa county through or near the city of Tuscaloosa will divide the county into two parts of unequal size, differing widely in soils, topography, and other natural features. North and east of this line the county is formed of the sandstones and shales of the Coal Measures; south and west, of the sands and loams of the stratified drift formation. These last-named materials, however, overlie the rocks of the Coal Measures in a belt 12 or 15 miles wide, lying northeast of the line alluded to. Southwest of this line the drift hides completely from view any underlying rocks, but northeast the Coal Measures are everywhere brought to light where the former has been removed by erosion. In the southeastern edge of the county, adjoining Bibb, there is a narrow belt, in Roup's valley, where the rocks of a still lower geological formation take part in the formation of the soils and in the production of scenery.

The Black Warrior river, which flows in general southwest through the center of the county, receives nearly all the drainage, and the Sipsey river, a tributary of the Tombigbee, drains the northwestern corner. This river is separated from North river, the principal tributary of the Warrior, by a ridge of sand and pebbles of the stratified drift, known as Byler ridge, upon which was one of the principal thoroughfares of the county before the days of railroads.

In all that part of the county where the rocks of the Coal Measures are at the surface the soils are mostly sandy, occasionally shaly or aluminous, and seldom very fertile. The uplands are timbered with the usual variety of oaks, hickory, and pine, and bring tolerably fair crops. In this part of the county the bottom lands of the river and creeks are most esteemed by farmers. From the northeastern corner down nearly to the city of Tuscaloosa the river bottoms are rather narrow, except in the great bends, and in some parts of its course, as at the Squaw shoals, the river flows between high, rocky banks, with almost no bottom lands on either side. The adjacent uplands, also formed by the same rocks, are very rugged, difficult to cultivate, and rather poor. A large area in the northeastern part of the county is thinly settled, but the woods are well stocked with deer and other game, which find excellent pasture in the grasses and leguminous plants which there abound. Below Tuscaloosa the river bottom (partly above overflow) to the lower limit of the county will average 1 mile in width, and has a reddish loamy soil and red subsoil, derived from the uplands, and forms the best farming area of the county. In all the southwestern part of the county, where the stratified drift is at the surface, the topography shows the usual variety characteristic of this formation.

From the lowlands along the river there is usually a rather abrupt rise of from 60 to 75 feet to a terrace or plain, which is often 5 or 6 miles wide. Upon this stands the beautiful city of Tuscaloosa. From this plain the ground rises from the river, sometimes gradually, sometimes abruptly, to the general level of the uplands, which upon the main water-sheds is not less than 250 or 300 feet above the water-courses. This elevation is not reached in the lower part of the county usually within 10 miles of the river. Throughout this part of the county the prevailing soils are brown loams of considerable fertility, overlying subsoils of red clayey loam, which in turn rest upon beds of gravel and sand. The bottom lands are more or less closely related to the uplands from which they are derived, but are usually rather more fertile, containing, as they do, the cream of the upland soils.

At some distance from the river, upon the water-sheds spoken of above, the soils are somewhat more sandy. The long-leaf pine grows upon the sandy soils in all the southwestern part of Tuscaloosa county, and also east and northeast of the city of Tuscaloosa for a distance of 25 or 30 miles, or nearly to the county limits. In these localities the rocks of the Coal Measures are covered with beds of pebbles and sand of the drift. The genuine piny woods are here, as elsewhere, rather poor and thinly settled, but, with a moderate outlay for manures, they yield very fair crops of cotton.

The greater part of the cotton crop of Tuscaloosa county is raised upon the soils derived from the drift and loam, and comparatively little upon those of the Coal Measures.

ABSTRACT OF THE REPORTS OF HON. A. C. HARGROVE AND JAMES R. MAXWELL, OF TUSCALOOSA.

(Both reports refer to the bottom lands of the Warrior river and the adjacent uplands.)

The growth of the cotton-plant depends to a great extent upon the temperature and humidity. In the bottom lands it is likely to be late, and therefore more exposed to frosts and the ravages of the caterpillar; and for these reasons the uplands are preferred for cotton where the soils are at all fair. On the uplands the cotton grows off well about the last of April, and matures about the third week in September. The picking sometimes begins the last week in August. On manured or fresh land it continues to make till frost; the most of it, however, is made by the middle of September.

The bottom lands of the Warrior river and tributary creeks are of two principal kinds, the stiff, yellowish soil and the loose gray. The two together make up the soils of the bottoms from Tuscaloosa to the southern limit of the county with a width of 1 mile and a length of 25 or 30 miles. The natural growth consists of beech, white and red oaks, sweet gum, poplar, elm, and cottonwood, with occasional dense thickets of cane. The stiff soil is a heavy clayey loam of a gray to yellow color, sometimes inclined to be black, especially when wet. The thickness varies from 8 to 12 inches. The subsoil is sometimes heavier, sometimes lighter, than the surface soil, and is of a yellowish or buff color when dry. When the surface soil is washed away, this subsoil appears to be almost barren, though shown by chemical analysis to be rich in potash and phosphoric acid. The barrenness is due to the physical condition. When dry, the subsoil becomes very hard, but absorbs water rapidly, and then becomes a sticky clay. It contains now and then soft, black gravel, and the whole is underlaid at varying depths by beds of sand and gravel. The stiff, yellow soils are difficult to cultivate, except in the proper seasons, for they are too sticky in wet and too hard in very dry weather. The loose, gray bottom soils are always easily tilled. The stiff soils are inclined to be late, cold, and ill-drained, while the loose gray soils, on the contrary, are early and warm.

The soil next in importance is the brown loam of the uplands. This makes from one-half to two-thirds of the uplands, the rest being sandy, piny woods. The timber consists of post, red, Spanish, and black-jack oaks, hickory, poplar, and short-leaf pine. The soil is in general a brown loam from 3 to 10 inches in thickness, with a heavier subsoil of reddish clay, which is often almost impervious. The subsoil rests upon beds of sand and gravel, occasionally mixed with clay, and often contains pebbles. These upland soils are early and warm when well drained, which is the case with most of them.

The long-leaf pine woods make up a considerable proportion of the highest uplands. The natural growth is the long-leaf pine, with black-jack and other species of oaks where the soil is more fertile. The soil is a light-colored, sandy loam, 2 or 3 inches in thickness, resting upon a sandy subsoil which often contains rounded pebbles of quartz. These sand and gravel beds underlie also the subsoil to considerable depths. The soils are always easily tilled.

The chief crops are cotton, corn, and oats, but many other crops grow well. The soil generally is perhaps best adapted to cotton, but bottom lands produce fine crops of corn. Fully one-half of the tillable lands are devoted to cotton culture. On bottom lands cotton grows from 5 to 8 feet high, on uplands from 3 to 4 feet, the latter being generally most productive. Cotton is inclined to run to weed on rich sandy bottoms in rainy weather. On the best lands the bale of 500 pounds is produced, but the average yield is a bale to three acres. A 475-pound bale requires from 1,545 to 1,660 pounds of seed-cotton. The fresh-land cotton is usually graded as middling uplands. Morning-glory, hog-weed, and crab-grass are specially troublesome. About one-fourth of the land originally tilled is now turned out, which produces well for two or three years, and then rapidly deteriorates. The slopes are much injured by washings; on the other hand, the valleys are often improved by the washings of the top soil from the uplands. The damage to slopes is prevented or checked by hillside ditching.

The cotton is shipped, as fast as prepared for the market, usually to Mobile, either by rail or by boat. The freight by rail is from $1 75 to $2, and by boat from $1 25 to $1 50 per bale.

GREENE.

(See "Central prairie region".)

HALE.

(See "Central prairie region".)

BIBB.

Population: 9,487.—White, 5,887; colored, 3,600.

Area: 610 square miles.—Woodland, all. Hilly lands with long-leaf pine, 310 square miles; 125 square miles in Cahaba coal-field; 100 square miles in Roup's valley; 75 square miles valley lands south of the Cahaba coal-field. About 120 square miles of the southern parts of the coal-field and the valleys are covered with the drift, and exhibit the characters of the gravelly hills with long-leaf pine.

Tilled land: 43,796 acres.—Area planted in cotton, 15,737 acres; in corn, 18,816 acres; in oats, 2,935 acres; in wheat, 3,125 acres; in rye, 151 acres; in tobacco, 36 acres; in sugar cane, 36 acres; in sweet potatoes, 368 acres.

Cotton production: 4,843 bales; average cotton product per acre, 0.31 bale, 441 pounds seed-cotton, or 147 pounds cotton lint.

The northwestern corner of Bibb county is occupied by the narrow trough of Roup's valley, which is well-defined as far south as the base line between the two surveys (which runs east and west about 12 miles north of Centerville). Below this the sands, loams, and pebbles of the drift hide all the underlying formations. The characters of Roup's valley, with its parallel ridges and subordinated valleys, have been given under Jefferson county.

In Bibb county the ridge which occupies the central part of the valley is quite conspicuous, and is in many places filled with iron ore of good quality. It embraces many acres of fine farming land where not too much broken. The color of the subsoil is usually a deep red; the soil is more sandy and of a brown color. Between this and the red-ore ridges, which are found near the margins of the valley, but not always prominent landmarks, are belts of valley land with gray and yellowish to red soils and red subsoils, mostly under cultivation. The quality of these soils varies with the locality. As a rule, they contain angular fragments of chert derived from the flinty limestones upon which they are mostly based. Of considerable extent also is a gray, gravelly soil, with light-colored subsoil, filled with fragments of flint. Between the red-ore ridges and the extreme margin of the valley on each side there are narrow depressions with a first-rate yellowish calcareous soil.

East of Roup's valley, and occupying the northeastern part of the county, are the Coal Measures of the Cahaba field. The southwestern limit of this field is near Scottsville. It is drained by the Cahaba river, and forms a very rugged and broken area, with prevailing sandy soils of no great fertility. Near the confluence of Shade's creek with this river is a region known by the expressive name of "the Uglies", almost uninhabited, and embracing some of the most broken land in the county. As a rule, the area formed by these Coal Measures is not densely populated, as the soil is not productive enough to offer any inducements to the settler.

Between the southern edge of the coal-field and a line running from Centerville northeast to the county line there is an area of valley land with flinty ridges and the other characteristics of the valley lands of central Alabama. In this area there are many tracts of fine farming land, with red, buff, and gray soils, derived from the cherty or flinty magnesian limestones of the country, and giving evidence of their origin in the great number of angular fragments of chert with which they are filled. The red lands are more fertile and better suited to the grain crops, while the gray lands, sandy, and timbered with pines, are preferred for cotton.

South of Pratt's ferry a mountain rim, composed of the chert of the sub-Carboniferous formation, incloses a basin of 2 or 3 square miles area with yellowish soil, differing from the usual red valley soils and derived from an entirely different series of rocks. This has its representative in the Dry valley soil of Cherokee county, an analysis of which has been presented on page 25.

The southern part of the county, embracing the lower 12 miles, depends for its topography and surface features essentially upon a single formation, the stratified drift. This formation consists of beds of sand, pebbles, and loam of great thickness, which overlie and hide from view the older rocks. The cultivated soils are mostly derived from a bed of red loam, which is usually the uppermost of the whole series, and which is nearly always prominent in the subsoils. In this part of the county the ridges and depressions are determined solely by the water-courses, and do not lie in parallel, sharply-defined belts, which are so characteristic of the upper part. The high lands separating the main streams have a brown-loam soil resting upon this red loam as subsoil. Its timber is a mixture of the various species of upland oaks, and as the top soil becomes more sandy the long-leaf pine associates itself with these, and the transition into the long-leaf pine woods takes place by gradual stages. Wherever the soil is very sandy or pebbly and the subsoil light the long-leaf pine is the prevailing growth.

Agriculturally, Bibb county shares the characteristics of the valley region and those of the pine hills and brown-loam uplands, the greater part of the cotton crop being raised upon the brown-loam soils. The subjoined report does not refer to any of the brown-loam or sandy soils, and for descriptions reference must be made to the descriptions under Perry, Hale, and Tuscaloosa counties, where entirely similar soils prevail.

ABSTRACT OF THE REPORT OF J. S. HANSBERGER, OF TIONUS.

(This report refers to the region of Six-Mile creek, a tributary of the Cahaba river.)

The two principal soil varieties described are the red clay loam lands and the gray sandy lands, which make about equal proportions of the region under consideration. The timber of the red lands is composed of oak, hickory, walnut, and poplar on the red lands, and chiefly of long-leaf pine on the other. The top soil of the red lands is a clay loam of a red to brown color from 2 to 10 inches in thickness, resting upon a subsoil which is of heavier quality and of deeper red color. This subsoil often becomes hard and almost impervious. The top soil of the gray lands is of lighter color and more or less sandy, and its subsoil is of a yellowish color, somewhat sandy also, and seldom becoming hard and "panny".

The cultivation of the land is easy in dry weather, but somewhat difficult in wet seasons. The chief crops are cotton, corn, wheat, oats, rye, barley, and sweet potatoes. The red lands are adapted to corn, cotton, and wheat; the gray lands to cotton and potatoes. About one-third of the land is planted in cotton, which grows to the average height of 3 feet. Deep culture and wet weather will make cotton run to weed. The yield per acre on fresh land is from 500 to 1,000 pounds, and it requires from 1,545 to 1,660 pounds to a 475-pound bale. The cotton from fresh lands rates as low middling. After ten years' culture (unmanured) the yield is from 400 to 800 pounds per acre. Rag-weed is most numerous after wheat and other small grain, while crab-grass is most troublesome in the cultivation of cotton. About one-third of the land originally cultivated is now turned out, and some portions of this land, when taken into cultivation again, produce well, but other portions are worthless. The washings of the slopes is being checked to a considerable extent by hillside ditching.

The cotton is shipped, as soon as prepared for the market, by railroad, mostly to Selma. The farmers sell most of their cotton to merchants, and these ship it. The usual freight charge to Selma is from $1 50 to $2 per bale.

PERRY.

(See "Central prairie region".)

CHILTON.

Population: 10,793.—White, 8,651; colored, 2,142.

Area: 700 square miles.—Woodland, all. Four hundred square miles of gravelly hills with long-leaf pine; 220 square miles metamorphic slate region; 80 square miles valley lands, Silurian, etc. (Part of the last two divisions are also covered with drift and partake of the characters of the gravelly pine-hills.)

Tilled land: 40,676 acres.—Area planted in cotton, 11,558 acres; in corn, 18,185 acres; in oats, 2,255 acres; in wheat, 4,507 acres; in rye, 60 acres; in sweet potatoes, 356 acres.

Cotton production: 3,534 bales; average cotton product per acre, 0.31 bale, 441 pounds seed-cotton, or 147 pounds cotton lint.

The eastern part of Chilton county is formed by the crystalline rocks, the western part by the strata of the drift formation, and at the line of separation of the two, which is approximately along the line of the North and South Alabama railroad, there is a high ridge of the drift which forms the water-shed between the Coosa and the Alabama rivers. In many places this water-shed is 300 feet above the immediately adjacent streams. The course of the Coosa river, which forms the eastern boundary of Chilton, is nearly parallel with this ridge.

In addition to the above-named formations, there appear in the upper part of the county certain Silurian strata, which, however, are, as a rule, more or less covered with the beds of drift, and therefore not solely concerned in

the formation of the soils. Near Verbena, in the belt of crystalline rocks, there is an occurrence of hornblendic rocks which yield red and brown soils, and south of these are chiefly mica slates, yielding sandy gray soils, with much long-leaf pine associated with the oak growth. Northward from Verbena the gray soils prevail, and the long-leaf pine is nearly always present among the trees. Immediately north of the belt of red-colored soils mentioned as occurring near Verbena there is an area, formed by a much-decayed mica slate of purplish tinge, which yields an extremely sterile soil, upon which the chief growth is stunted long-leaf pines and black-jack oaks. In this region the surface is much broken. These slates are traversed by veins holding large masses of mica, which may some day be profitably worked. Northward from this the rocks are mostly siliceous and clay slates, with gray soils; long-leaf pine timber prevails, and the surface in places is exceedingly broken. The highest land in the county is probably to be found in this region. Of the specific characters of the red and gray soils here occurring little need be said, since similar soils have been mentioned under all the counties in which the crystalline rocks are more widely distributed.

The western part of the county formed of the strata of the drift presents the usual variety which characterizes that formation everywhere. These soils vary from the rich red and brown loams of the oak and hickory uplands to the gray sandy soils of the pine woods.

The water-shed mentioned as lying on the eastern border of the drift area is in general a high table-land with gray sandy soil and a splendid growth of long-leaf pine timber, supplying some of the largest saw-mills in the state, located along the line of the North and South Alabama railroad. This pine region extends southward into Autauga and Elmore counties, and analyses of several typical soils of these pine forests in the former county have been given on page 39.

Westward in the drainage area of Mulberry creek and of the other small streams of the county brown-loam soils of very good character are found and are in cultivation. This part of the county also is much more densely populated and is of much more importance, agriculturally, than the eastern, where the pine timber and the mineral resources are the chief interests.

The agricultural capabilities of Chilton county are quite similar to those of Autauga on the one hand, and of Coosa on the other.

Cotton is hauled to the stations on the North and South Alabama and Selma, Rome, and Dalton railroads, and there sold to merchants, who ship it thence to the various markets.

AUTAUGA.

Population: 13,108.—White, 4,397; colored, 8,711.

Area: 660 square miles.—Woodland, all. Gravelly hills, with long-leaf pine, 560 square miles; calcareous lands, 100 square miles.

Tilled land: 81,388 acres.—Area planted in cotton, 30,474 acres; in corn, 20,417 acres; in oats, 2,153 acres; in wheat, 700 acres; in rye, 63 acres; in rice, 43 acres; in sugar-cane, 22 acres; in sweet potatoes, 540 acres.

Cotton production: 7,944 bales; average cotton product per acre, 0.26 bale, 372 pounds seed-cotton, or 124 pounds cotton lint.

Autauga county is one of the counties situated upon the great pebble bed which covers and hides from view the line of contact of the older crystalline or metamorphic rocks and the newer Cretaceous, and, as might be expected from this circumstance, its upland soils are almost exclusively derived from these drifted materials.

The northern two-thirds of the county, viz, townships 18, 19, and all of 20 which lies within the county, are piny-woods land, hilly and timbered with long-leaf pine, and often with no other tree, except the black-jack oak. In many places, especially north of Kingston, even an undergrowth of shrubs is wanting, but grasses and leguminous plants flourish and afford excellent pasturage. The soil is coarse to fine sandy and often gravelly, and the red or yellow loam is almost entirely wanting, except in the subsoil, often at a considerable depth from the surface. In these lands only the hollows and creek flats are worth cultivating, and perhaps not more than one acre in thirty is, or ever has been, cleared up and in cultivation.

Coming southward, there is, as a rule, an improvement in the land, and pine land with red clay or clayey loam subsoil makes up a good part of townships 17 and 18. Some of these soils have a sandy subsoil; that is, the loam lies deeper below the surface. Nearly all the pine lands with clay subsoil have been cleared up, not because they are better in the virgin state than the soils with sandy subsoil, but because they lie better, are more level, and consequently last longer. As to productiveness, they are about equal, the fresh land yielding about 400 pounds of seed-cotton to the acre. About one-fifth of township 17 is table-land, level, and having an average elevation above the water-courses of 225 or 250 feet. The rest of the township is made up of the steep hillsides which border these table-lands and the creek hummocks, which are very much like the river hummocks. From the piny woods of the upper townships two strips of pine land run down into this township (17): the one, on the borders of Autauga creek, to the river; the other, on Whitewater creek, to within 2 miles of the river.

The table-lands have a natural growth consisting of short-leaf pine, red, Spanish, black, and post oaks, hickory, dogwood, black gum, etc. These have a clay foundation, and will yield, when fresh, from 1,000 to 1,200 pounds of seed-cotton to the acre. The same is true of the hillsides, which are good farming lands when level enough to plow and can be protected from washings.

There are two outcroppings of the calcareous rocks of the Cretaceous formation in the county, viz: one, about 5 miles long, lying between Nolan's and Bear creeks, in township 17, on the plantation of General Fair; the other near the river below the Dutch bend. Taken together, the area of these Cretaceous or prairie tracts is small, only about 10 sections. All of this kind of land that is level enough to plow has been cleared up, and it is equal to, or perhaps better than, any land in the county, yielding, when fresh, from 1,200 to 1,500 pounds of seed-cotton to the acre.

Nearly all of township 16 in this county is second-bottom or river-hummock land, and most of it is in cultivation. In this township also are the first bottoms of the Alabama river, which are very rich and productive; but being liable to overflow in the spring, are devoted almost entirely to corn, the yield of which is from 40 to 50

bushels to the acre. An analysis of a specimen of river-bottom soil from this county has been given on page 40. The hummocks and the table-lands are about equally productive, giving, as above stated, from 1,000 to 1,200 pounds of seed-cotton.

For many of the above-named facts I am indebted to Dr. S. P. Smith, of Prattville.

The southern boundary of Autauga county is made by the Alabama river, and the sandy loams of the second-bottoms of this river and of the streams that flow into it have produced the great proportion of the cotton crop. The calcareous lands in the southwestern part of the county, while of limited extent, are very superior cotton lands. The red or brown-loam table-lands also furnish fine plantations, but much of this land is badly worn, although, with proper care, susceptible of almost unlimited improvement.

ABSTRACT OF THE REPORT OF DR. C. M. HOWARD, OF MULBERRY.

(The region reported upon is in township 17, range 18, in the drainage areas of Beaver and Ivy creeks, and embraces the bottom lands of those streams, and also the hilly and table-lands of the same drainage area.)

The soils vary from tolerably stiff to light sandy clay loams, and include also the creek bottoms. The most important are the red land (loam soil), occupying about one-half to three-fourths of the region described. The timber consists of post, white, and red oaks, hickory, short-leaf pine, chestnut, dogwood, and sassafras. The thickness of the red soil is from 1 to 4 inches, the subsoil generally heavier, a close clay, often plastic, and containing occasionally pebbles. Beneath the subsoil are either sand, pebbles, or clay at varying depths. Alternating with the loam soils above named, and forming perhaps a fourth of the area under discussion, are the sandy lands with timber of long-leaf pine and black-jack oaks, and occasionally other species of oak. This is a much lighter soil, more sandy, and of gray to brown colors and from 1 to 3 inches in thickness, having a close yellow clay, more or less mixed with sand as subsoil. This subsoil also often holds, locally, beds of pebbles, and rests on sand and gravel, and in places on lime-rock, at varying depths. The bottom soils make from one-third to one-fifth of the area, and have a growth of oaks, poplar, beech, gum, iron-wood, etc. The soils are light, fine loams, often heavy, of gray brown to blackish colors, and from 3 to 8 inches in thickness. The subsoil, as a rule, is lighter than the surface soil, often containing pebbles, and is underlaid with sand and gravel.

Land is easily tilled in wet and dry seasons. The chief crops are cotton, corn, oats, and potatoes, the soil being well suited to all. Two-thirds of the tilled land is planted in cotton, which grows from 2 to 5 feet high—the higher the better for production. Early in the season, when fruitage is small and weather wet, cotton is inclined to run to weed. The average seed-cotton product per acre on fresh land is 450 pounds and on bottom lands 800 to 1,000, and it requires 1,660 pounds to a 475-pound bale. The cotton is usually graded as middling. After thirty years' continuous culture without manure the yield is from 300 to 400 pounds per acre. It only requires 1,545 pounds of seed-cotton from old land to make the 475-pound bale. After twenty years' rest for turned out land it will produce an average crop for 2 or 3 years. The soil on slopes is often much damaged by washings, and no efforts have been made to prevent the injury.

The cotton is shipped, either by river or railroad, to Montgomery, Selma, or Mobile. The rate from lower Autauga to Selma is $1, and to Mobile $1 50 per bale. From the upper part of the county the shipments are mostly to Montgomery.

ELMORE.

Population: 17,502.—White, 8,747; colored, 8,755.

Area: 630 square miles.—Woodland, all. Gravelly hills with long-leaf pine, 230 square miles; crystalline or metamorphic area, 400 square miles. Of the last-named area 175 square miles are also covered with the drift, making in all 405 square miles in which the drift soils prevail.

Tilled land: 73,897 acres.—Area planted in cotton, 31,045 acres; in corn, 20,000 acres; in oats, 5,153 acres; in wheat, 3,883 acres; in rye, 27 acres; in rice, 5 acres; in tobacco, 12 acres; in sugar-cane, 16 acres; in sweet potatoes, 642 acres.

Cotton production: 9,771 bales; average cotton product per acre, 0.31 bale, 441 pounds seed-cotton, or 147 pounds cotton lint.

Elmore county, like Lee, embraces the line of junction of the older crystalline rocks and the Cretaceous, but this line of contact is, as usual, hidden by the great accumulation of pebbles and sand of the post-Tertiary. None of the Cretaceous beds, so far as yet known, come to the surface, and the soils are made exclusively of the disintegrated metamorphic rocks or the overlying drift loams. The crystalline rocks form the county north of the latitude of Wetumpka, and in this area are the usual red and gray soils, elsewhere described as derived from the gneisses which constitute the greater part of the strata.

The gray lands predominate greatly in Elmore county, and are derived either from gneisses or from mica slates. Their fertility varies on this account between wide limits, as the mica slates, as a rule, yield soils of no great value, while some of the gneissic soils are of excellent quality. From 8 or 10 miles north of Wetumpka, southward, the stratified drift covers the country rocks everywhere, except where the drainage has cut through to the underlying beds.

The Coosa river above Wetumpka has rather narrow bottom lands, but beyond the bottoms, and of 2 or 3 miles width, is a tolerably level plain with sandy soil (occasionally mingled with pebbles), timbered with long-leaf pine. West of the river, in the latitude of Wetumpka, the country is an almost perfectly level plain to the Autauga county line, with an occasional slight elevation caused by an accumulation of pebbles. Upon this plain the soil is sandy and the subsoil rather stiff, so that the roads are always firm and hard, notwithstanding the sands. The timber is one unbroken forest of long-leaf pines, with very little shrubby undergrowth, but with a great variety of herbaceous plants, with showy flowers, especially in the moist depressions. Along the Tallapoosa, and in the fork of the Coosa and Tallapoosa rivers, there are tracts of first-class bottom lands, which have for many years yielded heavy crops of cotton.

The higher bottom lands above overflow and the second bottoms of the two rivers that form the southern and western boundaries of Elmore are perhaps the best cotton lands in the county, but some of the brown-loam table-lands and of the better quality of gneissic soils yield excellent crops. Shipments are made either by rail or by boat on the Coosa.

MONTGOMERY.

(See "Central prairie region".)

TALLAPOOSA.

(See "Metamorphic region".)

MACON.

(See "Central prairie region".)

LEE.

(See "Metamorphic region".)

RUSSELL.

(See "Central prairie region".)

THE CENTRAL PRAIRIE REGION.

This division comprises the whole or part of the following counties: Pickens,* Sumter, Greene, Hale, Marengo, Perry, Dallas, Wilcox,* Butler,* Lowndes, Autauga,* Montgomery, Crenshaw,* Pike,* Bullock, Macon, Russell, and Barbour.

PICKENS.

(See "Gravelly pine-hills region".)

SUMTER.

Population: 28,728.—White, 6,451; colored, 22,277.

Area: 1,000 square miles.—Woodland, all except a few isolated patches of open prairie, the extent of which cannot be given with accuracy, but is about 35 to 40 square miles; central prairie region, 575 square miles; post-oak flatwoods, 175 square miles; oak and hickory uplands with long-leaf pine, 250 square miles.

Tilled land: 172,100 acres.—Area planted in cotton, 80,662 acres; in corn, 51,402 acres; in oats, 2,706 acres; in wheat, 24 acres; in rye, 162 acres; in sugar-cane, 42 acres; in tobacco, 13 acres; in sweet potatoes, 1,056 acres.

Cotton production: 22,211 bales; average cotton product per acre, 0.28 bale, 399 pounds seed-cotton, or 133 pounds cotton lint.

A line running northwest and southeast through Livingston would mark approximately the limit of the prairies which form the upper part of Sumter county down to that line. This part of the county has an average elevation of about 150 feet above tide, and is underlaid throughout with the rotten limestone of the Cretaceous formation. This material is directly concerned in the formation of a considerable proportion of the soils, which are in some cases little more than the disintegrated limestone mixed with organic matter. Where this rock forms the surface the country is gently undulating, and the differences in level are very slight. Interspersed, however, throughout this whole canebrake region are ridges and hills capped with sand and pebbles of the stratified drift formation. These ridges are occasionally elevated 150 feet and more above the surrounding country and 250 feet above the river. Their distribution, structure, and other circumstances point to the conclusion that they are the remnants of a once universal covering of drift. Where this formation is at the surface the soils are sandy loams of the usual drift type. These loams, in mingling with the disintegrated limestone, give rise to a class of soils known as post-oak or prairie soils. As will be seen in the abstract of Dr. Webb's report, there are all gradations between the sandy loams and the black prairie soils. The open or bald prairie spots form only a small percentage of the whole area formed by the Cretaceous limestone (less than one-tenth).

Southwest of the line above alluded to, and occupying a belt varying in width from 5 to 8 miles, are the so-called flatwoods or post-oak flatwoods. This division shares with the prairies their gently undulating surface and elevation above tide. It rests, however, upon a bluish, tenacious clay of the lowest Tertiary formation. Like the prairies, this belt is covered in spots with the sands and other material of the drift, and the varieties of soils thus produced by intermixture are quite numerous. Beyond the flatwoods, in the southwestern part of the county, the sandy and clayey strata of the lignitic group of the Tertiary are, as a rule, hidden from view by the overlying beds of sand and pebbles and red loam of a later formation. This portion of the county presents the usual characters of the drift regions so often previously described. The high, level table-lands which occupy the main watersheds have a sandy-loam soil and red-loam subsoil resting upon sand and pebbles, and these in turn overlie the laminated clays and other beds of the lignitic group. Sometimes the surface is made up of deep beds of sand, as is the case near Gaston. The growth upon these sandy tracts consists mostly of long-leaf pine and black-jack oak. Beds of lignite are exposed in many places throughout this section, and one of these, in a cut along the Alabama Great Southern railroad, has been on fire for many years. As yet this lignite has not been profitably used as a fuel.

The agricultural relations of Sumter county are similar to the adjoining counties of Mississippi and Alabama, which are situated in the same belt, which is pre-eminently the cotton belt of the state. While the soils of this belt are, perhaps, in the elements of plant-food, not much superior to those of other divisions, they are rendered more thrifty by the usually notably large percentage of lime.

ABSTRACT OF THE REPORT OF DR. R. D. WEBB, OF LIVINGSTON.

(This report refers to the bottom lands of Sucarnotchie river, a tributary of the Tombigbee, and to the prairies and uplands drained by the same.)

The three soils described are: the prairies or black lands, the upland and alluvial (creek bottom) sandy soils, and lastly the post-oak flatwoods.

The basis of the first is the Cretaceous limestone, that of the last a dense, firm, blackish-blue clay, and that of the sandy uplands the drift or orange sand overlying the two former. The region about Livingston is a spotted one, having, in addition to the three primary soils above mentioned, quite a variety of mixed soils, such as sandy flatwoods, prairie flatwoods, sandy prairie, prairie loam, etc. There is very little bottom land on the Tombigbee in this section.

The black prairie soil forms two-thirds of the lands in township 19, ranges 1, 2, 3, and 4 west, and extends northwestward to Mississippi, and in the other direction, through Marengo, Greene, Hale, Perry, Dallas, and Montgomery, to Macon county. The timber is a mixture of post, red, and white oaks, hickory, ash, walnut, and cedar. The soil is black, putty-like prairie, with no subsoil properly speaking, as the soil rests directly upon the underlying limestone, from which it has been derived. Its thickness is quite variable (from 3 to 5 feet, sometimes 10 to 12). This soil is easily tilled when dry, but difficult when wet.

The sandy uplands make up one-sixth of the region in question, and are widely distributed. The prevailing timber is chestnut, black-jack, red, and white oaks, hickory, black and sweet gums, long-leaf pine, and occasionally poplar. The soil is a sandy loam of brown to yellowish colors, with an average thickness of 1 foot to the subsoil, which is a red-clay loam, containing occasionally rounded pebbles of quartz.

The post-oak flatwoods form one-sixth of the region described, and extend northwestward to Mississippi and southeastward nearly to the Alabama river, in upper Wilcox county. The natural growth is post oak, pine, and hickory. The soil is usually a putty-like clay of a brown color, often 10 to 15 feet thick and without a distinct subsoil, and is underlaid below the depth of 10 or 15 feet with a stiff black clay impervious to water. From its nature this soil is difficult of cultivation, late, cold, and badly drained.

Of these soils the prairies are about equally well adapted to corn and cotton, the open prairies perhaps being best for corn. The other two soils are best suited to cotton, and this is almost the only crop on the flatwoods. On the prairies the stalk attains the height of 3 to 7 feet, being most productive at 5 feet. On the other soils the best height is about 3 feet. In wet seasons the cotton sometimes runs to weed, and the only remedy used (and this very seldom) is topping in August. The seed-cotton product on the fresh lands (prairies) is from 1,200 to 1,500 pounds; on the uplands and in the flatwoods, 600 to 1,000 pounds, about 1,660 pounds being needed in each case for a 475-pound bale. The staple rates from low middling to middling. After twenty-five or thirty years' cultivation (without manure) the yield is brought down to 300 or 400 pounds, with about the same proportion of seed to lint, and with very little difference in the quality of the staple, which, if anything, is not quite so good, but a little shorter. The most troublesome weeds are crab-grass, purslane, careless-weed, and coffee-weed. One-third of the uplands formerly in cultivation now lie turned out. Of the other lands very little has been abandoned, and of the flatwoods more is in cultivation now than ever before. In all cases where again taken into cultivation the land produces well. In the prairies and uplands there is some injury from washings, and the valleys suffer to a slight extent; in the flatwoods, on account of their level nature, there is no injury from this cause. Hillside ditching has been practiced to a limited degree, and with good success where properly done.

Shipments of cotton are made, as soon as it is ready, by steamer and by rail, to Meridian and Mobile. The freight rates to Meridian are $1, and to Mobile $1 25 per bale.

GREENE.

Population: 21,931.—White, 3,765; colored, 18,166.

Area: 520 square miles.—Woodland, all except a few small patches of open prairie, aggregating perhaps 25 square miles; prairie region, 395 square miles; pebbly hills, with long-leaf pine, 125 square miles.

Tilled land: 119,426 acres.—Area planted in cotton, 63,643 acres; in corn, 31,826 acres; in oats, 2,163 acres; in wheat, 314 acres; in rye, 25 acres; in sugar-cane, 25 acres; in tobacco, 41 acres; in sweet potatoes, 705 acres.

Cotton production: 15,811 bales; average cotton product per acre, 0.25 bale, 357 pounds seed-cotton, or 119 pounds cotton lint.

Greene county occupies a position with reference to the geological formations similar to that of Perry and Hale. In the northern part is the belt of drift of which mention has frequently been made, and in the southern the prairie region underlaid with the rotten limestone. The Warrior river makes its eastern and the Tombigbee its western boundary. The highest land in the county is situated in the northeastern part, within the drift area, where the main water-sheds are probably some 350 or 400 feet above the river-level. The average elevation of the prairies may be given at about 170 feet above tide, and the line between the drift belt and the prairies runs northwest and southeast through or near Eutaw, the county-seat. Northeast of this line the country is broken and hilly; southwest only gently undulating, with here and there a ridge or hill capped with the sands of the drift, the relics of a covering which once probably was spread over the whole prairie region.

The bottom lands of the Warrior river as far as Eutaw are about 1 mile in width, and are good farming lands, but are liable to overflow. From this bottom land there is a rise of 75 or 80 feet to a terrace or plain (second bottom or hummock), often 5 or 6 miles wide, with brown-loam soil and red clayey-loam subsoil, and from this there is an ascent to the table-lands, sometimes rather abrupt, but more often in several offsets. The soil and subsoil of the table-lands do not differ very materially from those of the terrace below, except that the lower plain is often more sandy than the table-land. Below the red loam, which forms the subsoil of both, are beds of sand and pebbles. The hills which border the table-lands have this red loam often at the surface, and the underlying pebbles also are frequently exposed by the removal of the loam. Red clay and gravelly hills are numerous and characteristic throughout the whole length of this drift belt.

The prairie region in Greene county has the features which have been described somewhat in detail under Hale and Sumter counties. In the lower part of this county, in what is known as the "fork", the lands are very much like those about Livingston, on the other side of the Tombigbee, and consist of calcareous or prairie lands, alternating with sandy ridges, sometimes capped with pebbles. This part of the county has always been celebrated, especially in *ante-bellum* days, for its fine cotton plantations.

In its agricultural features Greene county shows two widely different divisions: the upper, with its brown-loam soils, and the lower, with prairie or calcareous soils, the greater part of the cotton being produced upon the calcareous or prairie lands. No report has been received concerning the prairie lands of Greene county, but that on similar lands in Hale county will apply equally well here.

ABSTRACT OF THE REPORT OF THOMAS J. PATTON, OF KNOXVILLE.

(This report refers to the country drained by Sims' and Buck creeks, tributaries of the Warrior river.)

Three principal soil varieties are named, viz: sandy, rolling uplands; sandy, loamy bottoms of Sims' and Buck creeks, and the dark sandy loam of the Warrior river bottom. Of these the sandy uplands are most important, making at least three-fourths of the country about Knoxville. The timber consists of pine, oaks, hickory, ash, and gums. The soil is a fine sandy loam, dark on the surface and lighter colored underneath. The subsoil is generally a red clay, a little sandy, and almost impervious to water, underlaid with sand and pebbles, and occasionally a thin stratum of sand-rock at varying depths. The bottom soils above mentioned are not particularly described, as there is but little difference between the uplands and the bottoms, except that the latter are somewhat more level and more productive, especially for corn.

The land is easily tilled in wet and dry seasons. The chief crops are cotton, corn, oats, and potatoes, but the soil seems best adapted to cotton and potatoes. More land is planted in cotton than in all other crops combined. The average height of growth of cotton is 3 feet, and stimulating manure promotes fruiting more than growth. The seed-cotton product per acre on fresh land is 700 pounds, and 1,545 pounds are requisite for a 475-pound bale. This cotton rates as middling. The product per acre is reduced one-half by twenty years' culture without manure. From such worn lands it takes 1,600 pounds to the bale, and the staple is graded low middling. Crab-grass is very troublesome on this soil. About one-fourth of the land is turned out, but it is soon covered with a dense growth of pines, and if allowed to rest, say 20 years, it produces well. The hillsides, if neglected, are much injured by washings, but the washings of the top soil from the slopes is a benefit to the valleys.

Shipments of cotton are made chiefly in January and February by steamer to Mobile. The usual rate of freight to that port is $1 50 per bale.

HALE.

Population: 26,553.—White, 4,903; colored, 21,650.

Area: 670 square miles.—Woodland, all except a few tracts of open prairie; prairie region, 345 square miles; gravelly hills with pine, 325 square miles.

Tilled land: 140,072 acres.—Area planted in cotton, 69,995 acres; in corn, 43,254 acres; in oats, 3,671 acres; in wheat, 1,437 acres; in rye, 56 acres; in rice, 16 acres; in tobacco, 16 acres; in sweet potatoes, 1,214 acres.

Cotton production: 18,093 bales; average cotton product per acre, 0.26 bale, 372 pounds seed-cotton, or 124 pounds cotton lint.

Hale county, in its topography, geology, and other natural features, bears a strong resemblance to its neighbor Perry on one side, and to Greene on the other. Its upper half, nearly to the latitude of Greensboro', the county-seat, is formed of rolling uplands, which are so characteristic of the drift belt frequently alluded to. The lower half, on the contrary, is chiefly prairie land, very slightly undulating, and very little elevated, as a rule, above the water-courses. In the uplands the red loam, which overlies to a depth of 15 or 20 feet the sands and pebbles of the drift, forms all the most important soils and subsoils.

The table-lands, and the better class of uplands generally, have a brown-loam soil with red clay subsoil. This brown loam passes, on the one hand, into a light sandy soil, with long-leaf pine as the prevailing growth, and on the other into a stiff reddish soil with a considerable percentage of clay. The rocks which may underlie this drift deposit are hidden from view north of Greensboro'. In the vicinity of Havana, in the upper part of the county, the pebble and other materials of the drift are, in places, cemented together by hydrated oxide of iron into a rock of considerable hardness. At Havana this rock forms cliffs along the sides of a deep ravine, and fragments of it, often as large as a good-sized cabin, have been broken off and have rolled down the glen. Under the overhanging rocks on the sides of the ravine are growing some of the rare ferns of the state. (*a*)

The bottom lands of the Warrior river in Hale county are similar to those described at some length under Tuscaloosa county, and are generally well suited to corn, but less so to cotton. The average width of these bottom lands on both sides of the river is about 1 mile. Above the bottom lands is a level plain or terrace from 75 to 100 feet above the bottom proper, and in places some 5 miles wide. The soil upon this terrace or second bottom is a sandy loam, which is extensively cultivated, and which produces excellent crops, especially of cotton. From this terrace there is a gradual or abrupt ascent to the table-lands, which have a brown-loam soil and a red-clay loam subsoil, and vary from 300 to 400 feet above the river-level. Beneath the red-loam subsoil are beds of sand and gravel, often of great thickness. In ascending the hills bordering the table-lands these pebbles are passed over along most of the roads a short distance (15 or 20 feet) below the summits. The red-clay subsoil is found also beneath the soil of the lower terrace above spoken of, and this also overlies beds of pebbles and sand, as is the case with the table-lands. This appears to show that the face of the country had already suffered denudation prior to the deposition of the upper portion at least of the drifted materials, and that the more important of the river valleys had already been marked out. The soils of this terrace are, as a rule, rather more sandy than those of the higher table-lands, though otherwise the two have many points of resemblance.

The prairie lands of the southern part of the county are of the usual character, and are well described in the abstract of Mr. Harris' report given on page 121.

Some of the best of the canebrake lands of the state are situated in Hale county, and the uplands and river-lands of the northern part of the county are among the best of their class.

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a Among others are *Camptosorus rhizophyllus*, Link; *Trichomanes radicans*, Swartz; and *Asplenium ebenoides*, Swartz. The last-named exceedingly rare fern was discovered in this locality by Miss Julia Tutwiler, the only other known locality in the United States being the banks of the Schuylkill river.

ABSTRACT OF THE REPORTS OF PROFESSOR HENRY TUTWILER, OF GREENE SPRINGS, AND NORFLEET HARRIS, OF LANEVILLE.

(These reports refer to the table-lands and bottom lands along Five-Mile creek, in the upper part of the county, and to the prairie and other lands lying adjacent to Big Prairie and Dry creeks, in the southern part. Professor Tutwiler's report describes the upland soils, which are chiefly sandy and red-clay soils, the former being best adapted to cotton, the latter to corn. Reference is made also to the dark sandy soil of Five-Mile creek and the Warrior river. The report of Mr. Harris describes the most important soils of the canebrake region. These are the first and second bottom lands of Big Prairie and Dry creeks, and low slough lands, and, in addition, the rolling-prairie lands of black and brown colors.)

The most important are the sandy and the red-clay soils, which make two-thirds of the land about Havana, the first a light-colored sandy loam, the latter a rather heavy clay loam of a brown to red color. The natural growth upon these consists of oaks, hickory, gum, short-leaf pine, poplar, etc. The subsoil is a red-clay loam, which, on cultivation, becomes like the surface soil. This rests upon beds of sand and gravel, and in certain localities upon the conglomorate above alluded to. Tillage is rather difficult in wet seasons, and the red soil also is difficult of tillage in dry weather, as it is disposed to crack. They are both naturally well drained.

The red lands are somewhat difficult to till in dry seasons, the chief crops being cotton, corn, oats, and potatoes. The sandy land is best suited to cotton; the red land to corn. About one-half of the land is planted in cotton, and the average height of growth is 3 to 4 feet. Too much rain in July causes cotton to run to weed; but this may be largely prevented by topping and shallow plowing. The seed-cotton product per acre on fresh land is from 800 to 900 pounds, and it requires 1,545 pounds of seed-cotton to a 475-pound bale. After ten years' continuous culture without manure the yield per acre is 400 pounds, and it takes 1,660 pounds of this cotton to the bale. Crab-grass, rag-weed, and bramble are nuisances to the farmer. Nearly all the turned-out land has been reclaimed within the last few years, and yields well for a short time. The hillsides are injured, but the valleys are generally benefited by washings.

A wet May is very injurious, as the land cannot be worked and the crab-grass gets the start of the farmers. Even more disastrous is excess of rain in July and August, when the cotton is fruiting most. When these months are hot and dry, immense crops of cotton are always made.

The three chief varieties of soil are as follows:

Rolling prairie lands of black or brown colors, which make about 50 per cent. of the area about Faunsdale. This soil, intermixed with those described below, make up the canebrake country for many miles in each direction. The prevailing timber consists of the various species of oaks, ash, hickory, sweet and sour gums, etc. The soil is a dark calcareous clayey loam 15 to 18 inches in thickness, resting upon a subsoil of a grayish or neutral-tinted clay, putty-like, but apparently quite fertile, since, when thrown up out of ditches, it produces a fine crop the first year. This clay is almost impervious, containing no pebbles or concretions, and is underlaid with a blue lime rock at 20 feet depth (rotten limestone). In wet weather cultivation is difficult, but in dry weather easy, and grass and weeds are then easily killed. This soil may be classed as early and warm when well-drained.

The next soil in importance is that of the rolling prairie lands of yellowish or red colors, commonly called post-oak prairies. These make up perhaps 35 per cent. of the country about Faunsdale, and have about the same distribution as the black prairies before mentioned. The timber is much the same as that upon the other land, with the exception that the post oak is the most characteristic tree. The soil is a clay loam, stiff and somewhat putty-like when wet, of buff, yellow, brown, and mahogany colors, and more particularly chocolate-colored in places. Its thickness is from 18 to 20 inches before change of color to that of the subsoil, which is heavier than the surface soil, being a stiff grayish clay, yellowish in places, and almost impervious. This subsoil contains no pebbles or concretions, and is underlaid with a blue lime rock, like the black soils (rotten limestone), at a depth of 20 feet. In wet weather this soil is difficult to cultivate, as it is very sticky; in dry seasons, however, it crumbles easily, and is readily tilled, being early and warm and usually well-drained, as the surface is quite rolling.

Lastly, a loose walnut prairie land makes up a small proportion of the country about Faunsdale. The growth is nearly the same as that upon the other lands described, with some cedar and black walnut in addition. This soil is a fine, loose silt or prairie of whitish to gray color, often 3 feet in thickness, with a subsoil of a white, heavy, putty-like clay, almost impervious to water. It contains occasionally a few rounded pebbles, and is underlaid, like the others, with the rotten limestone. These lands are somewhat difficult to cultivate in wet seasons, but are the easiest of all in dry weather, and are the best corn lands. The soil is late, and is not so well drained as the others. All these soils are planted in corn, cotton, oats, etc., the first two being best suited to cotton, the latter to corn. The post-oak land is perhaps the best for cotton, and, where a farmer has several varieties of soil on his place, two-thirds of the post-oak land is put in cotton. Two-thirds of the open ground of the black prairies also are put in cotton, but very little of the walnut lands is ever so planted. From 3½ to 4 feet is the most productive height of stalk. In wet seasons there is a tendency to run to weed, which is restrained by topping, or, as some prefer, by plowing close, so as to cut the side roots.

The average yield of seed-cotton on the fresh land is 1,200 pounds, from 1,485 to 1,660 pounds being needed for a 475-pound bale, the staple rating as good middling. Thirty to thirty-five years' cultivation without manure will bring down the yield to 800 or 900 pounds, and with very little difference either in the quality of the staple or in the proportion of lint to seed. Most of the land in the canebrake country has long been under cultivation, and the average yield is as above given. The post-oak land is thought to respond best to fertilizers. Crab-grass and morning-glories are the most troublesome weeds on the black lands, crab-grass and pepper-weed on the post-oak lands, and cockleburs, morning-glories, and water-grass on the walnut lands. At present all of the cleared land is in cultivation; formerly a large proportion (10 per cent.) was turned out. When reclaimed it takes usually about two years to conquer the weeds and grass, and the lands do not, therefore, produce as well the first year, but after that, for several years, the yield is nearly as great as on fresh land. All these lands, where at all rolling, wash badly on the slopes, and the damage from this cause would be very serious but for the fact that this is prevented at once by hillside ditching, and in a few instances by horizontalizing also. The valleys are not injured, but, on the contrary, are much improved by the washings from the higher levels.

Shipments of cotton are made from October to January (chiefly in November and December) to Mobile and Selma, both by rail and by steamer. The freight charges to Mobile by boat are from $1 25 to $1 75 per bale; by railroad the charge is higher—from $1 75 to $2 85. These charges vary also with the locality.

MARENGO.

Population: 30,890.—White, 7,277; colored, 23,613.

Area: 960 square miles.—Woodland, all except a few square miles of open prairie; prairie region, 480 square miles; oak and hickory uplands with long-leaf pine, 380 square miles; post-oak flatwoods, 100 square miles.

Tilled land: 169,097 acres.—Area planted in cotton, 80,790 acres; in corn, 43,876 acres; in oats, 6,574 acres; in sugar-cane, 43 acres; in tobacco, 43 acres; in rice, 26 acres; in sweet potatoes, 1,138 acres.

Cotton production: 23,481 bales; average cotton product per acre, 0.29 bale, 414 pounds seed-cotton, or 138 pounds cotton lint.

The northern half of Marengo county is formed by the rocks of the Cretaceous formation, and the southern by those of the Tertiary, giving thus a considerable variety of geological features, while the soils overlying and more or less modified by these different formations exhibit corresponding varieties.

The Cretaceous formation is represented by the beds of the rotten-limestone group, and the physical features and soils peculiar to this group are sufficiently characteristic. The surface configuration of this territory is nearly level, or at most gently undulating, especially where the rotten limestone forms or is very near the surface, broken by irregularly distributed ridges, capped by the sands and pebbles of the stratified drift. The soils vary from the stiff calcareous clayey or prairie soils of the rotten limestone proper through all gradations to the light sandy loams of the superficial beds. Where the rotten limestone itself forms the soil, it is a heavy clay soil, usually of a dark tint, with a subsoil of a yellowish-green color, and likewise of heavy nature. The color of the soil varies from gray to black, according to the amount of vegetable matter present. Where the rock itself is sufficiently near the surface the soil is usually destitute of trees, and constitutes the bald prairies, which are irregularly scattered throughout the territory.

A second variety of soil is known as the post-oak soil. This is a heavy sandy clay of reddish or yellowish colors, usually timbered with a prevailing growth of post oaks and short-leaf pine. Analyses of these several varieties of soil are given under the regional description. The sandy ridges previously mentioned are found throughout this region, but are more abundant and continuous for greater distances near the southern border of the limestone area. The town of Dayton is situated upon such a ridge, and as it is approached from the north the surface becomes more broken, and the black or dark-colored heavy prairie soils of the rotten limestone give way to a reddish, somewhat sandy soil, with a growth of post oaks and short-leaf pines, beyond a narrow strip of which come the sandy soils of the ridge proper.

Between Dayton and Linden is a belt of hilly land, in which a sticky, yellowish clayey soil (hill prairie) is quite common, and which has a characteristic growth of short-leaf pine, hickory, and red and post oaks. The underlying rock, wherever seen in this strip between Dayton and Linden, is a hard yellowish limestone containing Cretaceous fossils. The whole aspect of the country, its soils, timber, etc., resembles the Chunnenugga ridge at Union Springs.

South of the latitude of Linden, and extending east and west across the county, is a belt 5 or 6 miles wide of a low, gently undulating country called flatwoods or post-oak flatwoods. These flatwoods rest upon a heavy grayish clay filled with reddish spots, which in wet weather becomes so tough and intractable that the roads through it are almost impassable. By reason of their unfavorable physical composition these lands are comparatively little cleared and cultivated, though the analysis of a specimen of the clay from near Linden, given on page 52, will show that it is by no means deficient in the elements of a good soil, except in the proportion of lime, which is small. Southward still of this, to the Clarke county-line, the lower beds of the Tertiary formation, consisting of dark-colored clays and sands (with which are interstratified beds of lignite and of shell marl containing greensand), underlie the superficial beds of sand and loam which in general constitute the soil and subsoil throughout this entire section. The lignite beds are occasionally of exceptional thickness, one on Landrum's creek being between 6 and 7 feet. Of great importance agriculturally are the beds of shell marl spoken of. One of these is exposed at the bluff of Nanafalia landing, and makes its appearance at the surface at several points eastward, where its intermixture with the surface loam has given rise to a kind of prairie or limy soil of great fertility. Beaver creek flows along the foot of the hills running parallel with these marl outcrops, and hence the very superior quality of the lowlands which border it.

Between the Beaver creek lands and the post-oak flatwoods rise some of the highest hills of the county, the Rembert hills, with an elevation of 350 feet or more above the river-level. These hills are covered with the red-clay loam and have a fine oak growth. Where the Linden road crosses them there stand the handsome residences of the planters, who cultivate the river lands which they overlook.

In Marengo county and the northern part of Choctaw the river lands are usually from one-half to three-quarters of a mile wide, of river front or high land, with a fertile sandy-loam soil, all in cultivation and occupied by some fine plantations. In the bends there is often a much greater width of this front-land, and at the Turner place, above Tuscahoma, it is 2 or 3 miles. Back of this high land is the swamp, 1 to 3 miles wide, heavily timbered with sweet gum, holly, swamp chestnut, oak, elm, scaly-bark hickory, and white oak. The swamp is entirely uncultivated and traversed with sloughs, and the roads across it, even in dry weather, are far from good, and in the winter are almost impassable. This seems to be the general nature of the river lands throughout the region in which the lowest Tertiary or lignitic strata make the country.

The brown-loam uplands of the southern half of the county south of the flatwoods are in all respects similar to those of other parts of the state, and require no special mention.

Agriculturally, Marengo is similar to the adjacent parts of Dallas, Perry, Hale, Sumter, and Greene counties, in the prairie region, and Wilcox and others, in the oak and hickory uplands. The report of Rev. Mr. Stickney gives all the needed details concerning cotton culture in the principal cotton producing part of the county, viz, the canebrake.

ABSTRACT OF THE REPORT OF REV. W. A. STICKNEY, OF FAUNSDALE.

(The uplands described are the rolling and flat lands, with partly a loose black-prairie soil, partly a mulatto or post-oak soil, and partly a light ashy-colored cedar-glade soil, all lying within the drainage area of Cottonwood and Powell's creeks.)

The bottoms are late, and hence the young plant is ravaged in its very prime by the caterpillar, and these pests have not for years permitted the climate to discriminate between the uplands and the bottoms. This region is known as the canebrake. The creeks are only drains or artificial canals, perfectly dry in summer, except in holes. The higher lands yield better in wet years; the flat or bottoms best in dry years. The three kinds of soil most prevalent are: First, the loose black-prairie soils, level and rolling, much of it lying on the larger drains and their tributary ditches, and in the main protected from injurious overflow; second, the mulatto or post-oak stiff soil, mostly upland; and third, light-gray cedar hummock soil, also upland. Of these the most important is the black-prairie soil, which, however, constitutes less than half the lands of the region under discussion; but all these soil varieties are so intimately associated with each other that in a few feet square all may be seen. Occasionally a large unbroken body of the prairie soil will be met with. The principal trees

are the various oaks, scaly bark, ash, hackberry, cedar, sweet gum, red, white, and slippery elm, walnut, hickory, poplar, cottonwood, papaw, buckeye, persimmon, dogwood, cane, and dwarf palmetto. The physical characters of the soils of course change with the soil variety, and these are the loose, limy prairie soils, the stiff, sticky clayey soils, etc., of mulatto, yellow, blackish, and black colors, alternating or mixed. The average thickness may be from 5 or 6 feet to as many inches, the white, rotten limestone very commonly outcropping on the uplands. The subsoil is the same as the soil, the cistern lime-rock underlying all the canebrake soil. In exceptional spots the soil contains white rounded pebbles of quartz. The tillage is not difficult if the soil is stirred at short and opportune intervals by the plow. When well-drained the soil is early; when ill-drained the bottoms are unproductive.

The chief crops in the canebrake are cotton and corn, and the soil seems to be about equally well adapted to each; if any difference, it is in favor of corn. Two-thirds of the cultivated area is, however, in cotton. The stalk varies in height from 2 to 4 or 5 feet, the latter height being best if the plant is not molested by the worm. When well worked and when overtaken by a rainy season the plant is inclined to run to weed, for which no remedy is known. Dirt thrown too high upon the stem (*a*) is regarded as an obstacle to bolling and very injurious when the dirt is hot. In favorable seasons the fresh land will produce from 1,200 to 1,600 pounds of seed-cotton to the acre (barring the caterpillar). The average for a 475-pound bale is 1,600 pounds. The staple is of the best quality.

As to the yield after long cultivation it is difficult to speak with precision. In one of the favorable years some of our land, worked consecutively for 40 to 50 years without manure, will yield from 1,200 to 1,600 pounds per acre, while the thin uplands will hardly turn out 300 to 400 pounds of seed-cotton. The staple from old land is usually thought to be shorter than that from the fresh land. The most troublesome weeds are the morning-glory, crab and other grasses, and hog-weeds. Chicken corn is now overrunning us from bad culture. From 10 to 20 per cent. of the uplands have been turned out in some places, and the amount is greatly on the increase. When these lands are again taken into cultivation they produce well if they have been fertilized in the meanwhile by common pea-vines or clover; otherwise, poorly. The soil washes badly on slopes, and the injury is very serious and constantly on the increase because of negligence. Where the ditches are kept cleaned out the damage to the valleys is very slight. Since the war very little has been done toward checking this evil. Before the war the system of horizontalizing was very perfect, but the art is fast being lost.

In the northern part of the county the cotton is shipped as fast as baled to the nearest station on the Alabama Central railroad, and is there sold to the cotton buyers. This is from August to December. In the lower part of the county (from which, however, no definite reports have been received) the shipments are probably to Mobile by means of boats on the Alabama and Tombigbee rivers.

PERRY.

Population: 30,741.—White, 7,150; colored, 23,591.

Area: 790 square miles.—Woodland, all. Gravelly hills, with long-leaf pine, 465 square miles; prairie region, 325 square miles.

Tilled land: 167,666 acres.—Area planted in cotton, 74,303 acres; in corn, 48,132 acres; in oats, 6,093 acres; in wheat, 440 acres; in rye, 70 acres; in rice, 27 acres; in tobacco, 24 acres; in sugar-cane, 20 acres; in sweet potatoes, 1,107 acres.

Cotton production: 21,627 bales; average cotton product per acre, 0.29 bale, 414 pounds seed-cotton, or 138 pounds cotton lint.

A belt composed of thick beds of sand and pebbles covers all the northern part of Perry county as far south as the line connecting Greensboro' and Marion. Within this area the natural features are those characteristic of the stratified drift everywhere. The face of the country is somewhat broken, though there are no great elevations, the main water-sheds being about 300 or 400 feet above the level of the Cahaba river, which receives directly or indirectly all the drainage of the county. Upon the highest land it is usual to find the soil somewhat sandy and supporting a growth chiefly of long-leaf pine. Along the slopes, and at lower levels generally, a brown-loam soil is very widely distributed, and the timber upon it consists of the various species of upland oaks, hickory, and short-leaf pine, with occasionally the long-leaf species. Beneath this brown loam there is a rather stiff red loam, usually called red clay, which is underlaid with pebbles and sand at varying depths. A not uncommon thickness for the red clay or loam is 20 or 25 feet. This part of the county, while not enjoying the reputation of the lower part, has still some excellent farming lands. The level table-lands, which have an average elevation of 200 or 250 feet above the water-courses, are nearly all cleared, and have been long in cultivation. In some cases, from neglect or careless cultivation, they are badly worn or turned out, but when reclaimed and properly treated they are among the most desirable lands in the county. Wherever the drift forms the surface there is no lack of the best of drinking water to be had from wells and springs. Marion, the county-seat, and a great educational center, stands on the southern limit of this drift belt, overlooking the prairies, which stretch away for 20 miles toward the south in a gently undulating, trough-like plain, lying between the drift hills on the north and similar ones on the south.

The rotten limestone formation of the Cretaceous forms the substratum throughout the prairie or canebrake country, and the topography and soils show very little variation. The prairie soil proper is a stiff, putty-like soil, originally gray, but usually of dark to black color (from organic matter). This soil can scarcely be said to have a subsoil, since it rests directly upon the rotten limestone, from which it is derived. The thickness varies greatly, the bare rock being exposed in many places without any soil at all, and in the sloughs and low places there is often several feet thickness of alluvial or made soil. The uniform level of the prairies is interrupted at intervals by low hills or knolls, which are capped with the sands and other beds of the drift. In many cases it appears that these elevations owe their existence to the protection afforded by these materials. Where the sands and loam of the drift are mingled with the calcareous soils of the prairies there is formed what is universally known as the post-oak prairie soil, which is a yellowish to reddish material of considerable fertility, characterized by the prevalence of the post oak among its timber trees. These are sometimes also distinguished as "woods prairies". Upon the sandy ridges and knolls of this section are situated many of the towns and settlements of the county, the abundance of good water and freedom from mud being the strong attractions.

The belt of prairie country underlaid with the rotten limestone has been given as about 18 or 20 miles wide. In the extreme southern corner of the county a bed of rather hard crystalline limestone is found resting

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a This high dirting in the midst of the plant's fruiting will commonly stimulate it to extra growth, but check fecundity for the time being, as if the two growths were too much at the same time. I have heard of breaking the roots by siding with a long colter plow, as a means of cutting off the excessive supply of sap, thus restraining weedy growth and favoring fruiting.

upon the rotten limestone, and as it is tolerably resistant to denudation the region of its occurrence is somewhat more broken and rugged than that where the rotten limestone is the surface rock. In the eastern part of the state this hilly region is known as the Chunnenugga ridge. The soil, where the overlying drift sands are in great thickness, is sandy and of no great fertility, but where on the slopes these materials have been partially removed by erosion the influence of the limestone is felt, and the soil becomes a calcareous loam of considerable fertility, approaching in character the soils of the post-oak prairies, which, indeed, are formed in a very similar manner. In the neighborhood of Marion, which is upon the extreme southern limit of the upper drift belt, the bluish micaceous clayey rocks of the lowest division of the Cretaceous formation may be seen in the deepest cuts and gullies, but they have very little influence upon the soils or topography, since they are covered with thick beds of the drift, and are not seen at all, even in the deepest cuts, much north of Marion.

Agriculturally this county shows two distinct characters: brown-loam uplands in the northern half, and prairie in the southern. Notwithstanding the greater inherent fertility of the latter region, the brown-loam lands are probably of more importance in the production of cotton.

ABSTRACT OF THE REPORT OF H. A. STOLLENWERCK, OF UNIONTOWN.

(The soils described are the black slough lands, the black and yellow post-oak lands, and the uplands.)

The uplands soils are considered the most important, and are distributed over the canebrake country in patches, making more than half of the tillable lands. These uplands occupy the slight elevations of the prairies, and the soils grade almost imperceptibly into those of the prairies. Intermediate between the two are the post-oak soils. The upland soil proper is a sandy loam, with subsoil of yellow clay. The color varies from light gray, through brown, to almost black, and the underlying rock is the rotten limestone, which is everywhere found at depths varying from 1 to 20 feet.

The chief crops produced are cotton and corn, the black or slough lands being best suited to corn, and the uplands to cotton. About two-thirds of the tilled land is in cotton, which attains the average height, when most productive, of 4 feet. The plant inclines to go to weed in wet weather, and no effectual remedy is known. The seed-cotton product of the fresh land is from 1,200 to 1,800 pounds, and 1,485 pounds are needed to make a 475-pound bale, which rates as middling. After ten years' cultivation without manure the yield is from 800 to 1,000 pounds, with no difference observable either in the proportion of lint to seed or in the quality of the staple if it is properly gathered and ginned. The most troublesome weed is the morning-glory. About one-fourth of the land originally in cultivation now lies turned out, and, as it is rolling, the soil washes away, and the reclaimed land is, on this account, not very productive. The valleys also are often injured to the extent of 10 per cent. by the washings from the uplands. Some efforts have been made, by horizontalizing and hillside ditching, to check the evil, and with very good success.

Shipments of the cotton crop are made between the months of October and January, usually by rail to Selma. The rate of freight is $1 75 per bale from Uniontown.

DALLAS.

Population: 48,433.—White, 8,425; colored, 40,008.

Area: 980 square miles.—Woodland, all except a few square miles of open prairie; prairie region, 830 square miles (rotten limestone or canebrake, 700, hill prairies, 130); gravelly hills, with pine, 150 square miles.

Tilled land: 207,404 acres.—Area planted in cotton, 115,631 acres; in corn, 46,542 acres; in oats, 8,260 acres; in wheat, 71 acres; in tobacco, 13 acres; in sugar-cane, 18 acres; in sweet potatoes, 2,256 acres.

Cotton production: 33,534 bales; average cotton product per acre, 0.29 bale, 414 pounds seed-cotton, or 138 pounds cotton lint.

Dallas county is traversed by the Alabama river, which flows through it from northeast to southwest. Its principal tributary, the Cahaba river, flowing southward, falls into it at the old town of Cahaba. The bottom lands of the Alabama river are sandy fertile loams, which are especially suited to the cultivation of corn. A second bottom, or terrace, often 5 or 6 miles wide, sometimes altogether on one side of the river, sometimes equally divided by the river, adjoins the true bottom lands. This terrace is generally sandy, and is almost a level plain. The soils are gray or light-colored, and are well suited to cotton. This terrace has an average elevation above the river of about 100 feet. From this out to the summits of the various dividing ridges there is a rise more or less gradual to the elevation of 350 or 400 feet, which may be taken as the average elevation of the table-lands above the river.

The geological structure, upon which depend the character and distribution of the soils, is simple. The underlying rocks are the strata of the Cretaceous formation, consisting, in the middle and northern part of the county, of an impure limestone, known as the rotten limestone, and in the southern of a yellowish, often crystalline limestone, and a bluish sandy marl. Over all these have been deposited beds of varying thickness of sand, pebbles, and loam of the stratified drift formation. From all these beds and their intermixtures the surface soils of Dallas county have been derived. In the northern part of the county, above Summerfield, the underlying rocks are completely hidden from view by the surface beds of drift, and the loams of this formation furnish the soils and subsoils, which have the usual variety common in such localities. The best of these soils is a brown loam, with red-clay loam subsoil, resting on sand or gravel. Its timber is a mixture of the upland oaks and hickory. With admixtures of sand the soil changes in character, and the timber with it, long-leaf pine being added to the growth and black-jack oak becoming prevalent. The extreme in this direction is seen in the upland pine woods, which occupy many of the pebbly and sandy slopes of the northern portion of the county. Several analyses, representing these soil varieties, have been given of soils collected in the neighboring county of Autauga (see page 39).

Going southward from Summerfield this brown-loam region, which is also universally known as the hilly country, extends to within 2 miles of Selma, where the river terrace is reached. As already stated, this terrace has a superficial covering of sand resting upon the rotten limestone, which is exposed wherever the streams have cut their channels a few feet below the general level. Within 2 miles of Selma, in the drainage area of Little creek, the black prairie soil is crossed nearly up to the city limits, and near the river the sands form the surface. From Selma to Cahaba is the same sandy river plain, the monotony of which is only broken in the vicinity of the streams.

Westward from Orrville to the limits of the county, and also northwestward, is a prairie or canebrake country of the usual character: a gently undulating region with no great elevations, having the rotten limestone at or very near the surface, yielding calcareous soils of gray to black colors, affording splendid hard roads in dry seasons, but almost impassable muds in the winter. Here and there throughout the prairie region are slight elevations

capped with sandy loams (sometimes associated with pebbles) of the drift formation, apparently the remnants of a once universal covering of these materials. The mingling of these loams with the calcareous soils gives rise to the formation of red sandy prairie soils, upon which the post oak seems to be most at home. On the eastern side of the river the same characters are to be seen out to the Lowndes county-line. The sandy ridges, which traverse the prairies, appear to be quite as characteristic of this region as are the prairie soils themselves. Orrville is upon one of these sandy belts. Many of the details concerning these soils and their composition are in the description of Perry and Marengo counties and in Part I, where several analyses of typical prairie soils have been presented (see page 47).

The yellowish, often crystalline limestone mentioned as underlying the lower part of the county is, like the rotten limestone, covered with the beds of the drift formation. These are, however, much more universally present here than in the central part of the county, where, as has just been said, they simply cap the ridges which traverse the prairies. The existence of hard ledges of limestone, alternating with softer strata, greatly influences the topography of this part of Dallas county. The table-lands, or high level country, at an average elevation of 350 or 400 feet above the river, have the brown-loam soils and red clayey loam subsoils of the best uplands resting on beds of sand and pebbles. The thickness of these beds may be put at 25 or 30 feet in the lower part of the county. Toward the streams these table-lands break off, usually quite abruptly, by reason of the hard limestone ledges alluded to, giving rise to the steep lime-hills of this section. The soils derived from these calcareous rocks are mostly yellowish calcareous loams, which at a certain stage of moisture form the most tenacious of muds.

The bottom soils of the creeks of this section are sandy and more or less affected by the lime of the neighboring hills, and as a consequence make fine farming lands. Of this character are the bottom lands of Cedar, Dry Cedar, and Mush creeks. In these bottoms, however, there are all gradations between black, limy, and loose sandy soils, according to locality. The villages of Carlowville and Pleasant Hill are situated upon plateaus with brown-loam soils, timbered with the usual variety of upland oaks. A descent of 25 or 30 feet from the level of these plateaus brings one to the calcareous rocks which underlie this part of the county. The lowlands along Dry Cedar and Mush creeks are from 2 to 3 miles wide, and are generally cleared and in cultivation, except where occasionally worn land has been turned out. Pebbles, often of large size, are commonly found along the slopes of the plateaus above alluded to.

Dallas produces more cotton than any other county of the state. To this its large area (980 square miles) contributes in an important degree, but its large proportion of rich prairie or canebrake and Alabama river lands would place Dallas county in the first rank in cotton production.

ABSTRACT OF THE REPORT OF J. F. CALHOUN, OF MINTER STATION.

(This report refers to the lands lying between Pine Barren and Dry Cedar creeks on the north and south, and between the lines separating ranges 10 and 11 and the Alabama river.)

The soils in cultivation in cotton are: 1, sandy uplands; 2, rolling or hilly prairie; and 3, creek bottoms.

The most important of these soils is that of the uplands, which makes at least one-half of the region described. The timber consists of species of oak, except pin oak, chestnut, hickory, gum, short-leaf pine, and chincapin. The top soil is usually a fine sandy loam of a gray color 6 inches thick, resting upon a subsoil of coarse red clay, which sometimes, though rarely, contains rounded pebbles of quartz. Beds of sand and gravel underlie the subsoil at the average depth of 10 feet. This soil is easily tilled, except in very dry seasons.

The rolling-prairie soil makes about one-eighth of the region described, not occurring in continuous tracts, but cropping out at different places. The timber is mostly post-oak, hickory, and black-jack. The top soil is a somewhat heavy shell prairie of a gray color, 8 inches thick, with a rather heavier subsoil of lighter color than the top soil, very hard and waxy. The subsoil contains shells and the fragments of the lime-rock which forms the general substratum of the section at varying depths. In wet seasons the tillage is difficult, and the lands are rather late and cold.

The creek bottoms, which border the two large creeks mentioned, and also the numerous smaller tributaries of the same, make about three-eighths of the lands of the section. Their natural timber growth consists of white and pin oaks, beech, hickory, ash, etc. The top soil is a coarse, sandy, often gravelly loam, sometimes a heavy clay loam; colors, gray to brown; subsoil, usually a white, stiff, crawfishy clay. White pebbles of quartz are not uncommonly found. The subsoil rests mostly upon sands, which is difficult to till in wet seasons. These lands are late, cold, and usually ill-drained.

The rolling prairies are best suited to grain crops, very little cotton being planted; the other two to cotton, which makes about three-fourths of the cultivated crops upon them. The height of stalk varies from 2½ to 3 feet, but is most productive at 3 feet. In wet seasons there is sometimes a tendency to run to weed, for which as a remedy the application of phosphates is suggested. The seed-cotton product per acre of the fresh land is 800 pounds, of which about 1,545 pounds are needed to make a 475-pound bale. The staple is rated as low middling. After thirty to forty years' cultivation without manure the yield falls off to less than one-half, and the staple becomes shorter and lighter. The rolling prairies, after a few years' cultivation, are injured badly by washes, and soon rust the cotton. The most troublesome weeds are hog-weed, cocklebur, morning-glory, and a species of purslane, which spreads close to the ground and seems to sap the moisture. Very little of the uplands is turned out, because the use of fertilizers has brought it into demand. The land seems to be very slightly benefited by lying out. A large proportion of the hilly prairies is abandoned, because thoroughly worn out and washed away. The subsoil is not usually washed off. The bottom lands are nearly all in cultivation, and are improved by resting, unless soured by lack of drainage. The uplands and rolling prairies are injured by washings, but the valleys adjoining are improved. Horizontalizing and hillside ditching are practiced with success in the uplands; in the hill-prairie region they are very little practiced, because of the very broken character of the country.

Shipments of the cotton crop are made mostly during September and October, by rail to Selma, from the lower part of the county, at $1 10 per bale. From other sections the other railroads and the Alabama river furnish the means of transportation. Selma is the great cotton market, not only of this county, but of neighboring counties in the canebrake region.

WILCOX.

(See "Oak and hickory uplands, with long-leaf pine".)

BUTLER.

(See "Oak and hickory uplands, with long-leaf pine".)

LOWNDES.

Population: 31,176.—White, 5,645; colored, 25,531.

Area: 740 square miles.—Woodland, all except a few square miles of open prairie. Prairie region, 740 square miles (470 rotten limestone and 270 rolling or hill prairies). In the prairie region a large area of the uplands are brown sandy loams.

Tilled land: 181,272 acres.—Area planted in cotton, 98,200 acres; in corn, 41,169 acres; in oats, 3,630 acres; in sugar-cane, 201 acres; in sweet potatoes, 1,004 acres.

Cotton production: 29,356 bales; average cotton product per acre, 0.30 bale, 429 pounds seed-cotton, or 143 pounds cotton lint.

In general, the agricultural features of Lowndes county are similar to those of Montgomery, which adjoins it on the east. The underlying country rocks are beds of the Cretaceous formation, and these are in places partly or wholly covered with the later beds of sand, gravel, clay, and loam of stratified drift. Most of township 16, in the limits of this county, lies within the river plain, and is made up chiefly of the first- and second-bottom lands. These have a general elevation of 30 or 40 feet above low-water mark, and are approximately level. The soils are mostly sandy, but very productive, especially in the first bottoms, and being subject to overflow, are usually planted in corn, of which crop 40 bushels to the acre are often made. These bottom lands, while prevalently sandy, still show the beneficial effects of the calcareous substratum. In many places there is a slight slope away from the immediate bank of the river, the foot of the first terrace being often as much as 10 or 15 feet lower than the actual river bank.

About the line between townships 15 and 16 there is a tolerably abrupt rise of 175 or 180 feet to a level, which between Lowndesborough and Manack's station is from 1 to 2 miles wide. This terrace has the drift and loam as surface materials, but the calcareous beds of the Cretaceous formation crop out in many places along the hillsides, separating the river hummock from the first terrace, and producing limy soils. Pebble beds also occur along this slope, but very few are seen as low as the hummock proper, except upon the summits and the sides of the little knolls, which rise above the general level of the river hummock. The soil of the first terrace above spoken of is a sandy loam of brown to gray colors with a subsoil of red-clay loam, and is in all respects similar to the soils and subsoils of the drift belt in other parts of the state.

From this first terrace there is a second rise of about 75 feet to the level of the Lowndesborough plateau, which has about the same elevation as the table-lands of Autauga county (some 250 or 260 feet above the river). Between Lowndesborough and Hayneville this plateau is five or more miles in width, and has all the characters of the table-lands of this latitude. The soil is a brown loam of considerable fertility, with a red-clay loam subsoil, which is in many places underlaid with beds of pebbles. The analysis given on page 39 of the table-lands soil of Autauga county will show fairly the general characters of this class of soils. The level nature of the land and the abundance of good water to be had everywhere in the sands and pebbles combine to make this and other plateaus of similar kind among the most desirable as farming lands and as places of residence.

Near the line between townships 14 and 15 there is a descent, going southward, of some 120 feet (usually in at least two terraces) to the general level of the prairies. Thence to about the line between townships 12 and 13 the black prairies continue with very little variation, and with approximately the same general level. South of this line the strata of the Upper Cretaceous formation, consisting of ledges of hard limestone, alternating with softer and more clayey beds, make the country down to the line of Butler county. Throughout this region the surface is much broken, the country being a succession of steep and sometimes rocky hills, with clayey, calcareous soils. In wet weather the soil becomes a very tenacious mud, which, together with the steep slopes of the hills, makes the country almost impassable for vehicles. The southwestern corner of the county, which is of this character, has the name of "Little Texas".

In a general way, this hilly country makes the water-shed between the north and south flowing streams, the former being tributaries of Manack's and Big Swamp creeks, the latter of Sepulga river and Cedar creek. One of the tributaries of the last-named stream, viz, Dry Cedar creek, drains this hilly country toward the north. The bottom lands of most of these streams are excellent farming tracts, but are in general best suited to corn.

The principal soil varieties have already been mentioned in passing. These are the sandy loam soils of the table-lands, the dark loam soils of the bottoms, and the calcareous soils of the prairies and lime-hills, and will be described more in detail in the following abstract.

Although the whole of Lowndes county lies within the prairie belt, yet there is a fair proportion of upland soils, which are derived from the transported beds of the drift. The agricultural characters of the county are thus quite varied, but are quite similar to those of the corresponding regions in other counties adjoining.

ABSTRACT OF THE REPORTS OF W. M. GARRETT, OF MOUNT WILLING, AND P. T. GRAVES, OF BURKVILLE.

(The lands described are within the drainage area of Pintlala and Cedar creeks.)

The upland soils vary from black prairie on the north to sandy loams on the south. In dry seasons the uplands are not so sure of a good crop as are the lowlands, but with moderately wet weather the former are far more productive. The red table-lands have a clay loam soil of a brown to reddish color, 10 to 18 inches in thickness, with a subsoil of red clay or loam, in the main free from pebbles and sand, and resting at a depth of 10 to 18 feet upon a bed of gravel and sand. The soil is usually easily tilled, warm, and well drained. The black prairie lands have a black or dark-colored soil of 8 to 10 inches thickness, passing gradually into the light-colored limestone, and have the usual characters of the prairie soils. The bottom soils are of several kinds, according to the surrounding uplands, and need no particular description.

The principal crops are cotton and corn, the latter being most productive on black lands, the former on sandy lands; but the red lands produce both crops equally well. From two-thirds to three-fourths of the tillable land is devoted to cotton. Cotton generally grows from 3 to 5 feet high, but in wet seasons it runs to weed, which can only be prevented by shallow culture and the free use of manure. Fresh land produces from 1,000 to 1,200 pounds of seed-cotton per acre, and a 475-pound bale requires from 1,485 to 1,660 pounds of seed-cotton. This cotton classes as low middling. Ten years' culture reduces the yield to 900 pounds, and fifty years' culture reduces it from 200 to 500 pounds, provided no fertilizers are used. Crab-grass is the greatest pest to cotton. Very little land is turned out; but when it is level it is easily restored to its former productiveness. The hillsides are somewhat injured by washings; the valleys are also sometimes injured, if the deposit is deep and composed chiefly of sand.

Two railroads, the Selma and Montgomery and the Montgomery and Mobile, traverse Lowndes county, and its northern boundary is made by the Alabama river. There are thus ample facilities for the transportation of crops to the markets. Cotton is usually sent by railroad, as fast as prepared for market, to Montgomery or Selma, at rates varying from 50 cents to $1 25 per bale, according to locality.

AUTAUGA.

(See "Gravelly hills region".)

MONTGOMERY.

Population: 52,356.—White, 13,457; colored, 38,899.

Area: 740 square miles.—Woodland, all except a few square miles of open prairie; 565 square miles of level and hilly prairies, of which 75 square miles has a coating of drift; 100 square miles of sandy and pebbly hills with pine.

Tilled land: 241,570 acres.—Area cultivated in cotton, 112,125 acres; in corn, 62,303 acres; in oats, 4,895 acres; in wheat, 58 acres; in sugar-cane, 174 acres; in sweet potatoes, 1,720 acres.

Cotton production: 31,732 bales; average cotton product per acre, 0.28 bale, 399 pounds seed-cotton, or 133 pounds cotton lint.

The Tallapoosa and Alabama rivers, where they form the northern boundary of Montgomery county, mark very nearly the line between the rotten limestone and the underlying Lower Cretaceous beds. These rivers, especially the Alabama, have wide hummocks or second bottoms above overflow and bottom lands of great fertility. The second bottom, or old river plain, is from 2 to 4 or 5 miles wide, and in some places, as between Benton and Montgomery, is very level, and where not too much covered with the alluvial sands is a fine farming region. Beyond the river plain is a ridge of sand, pebbles, and clay of the stratified drift, which gradually slopes away to the level or gently undulating prairie lands of rotten limestone, which form a belt across the middle of the county. In this belt the materials of the stratified drift are, in places, wholly wanting or in places present in limited quantity, where they are seen capping the small hills of the otherwise level prairies. Southward, beyond the black or canebrake belt, we encounter another accumulation of these drift materials overlying the sandy marls of the Ripley or Chunnenugga group of the Cretaceous formation.

The sands and laminated clays of the lowest division of the Cretaceous formation, while often exposed on the river bluffs, do not come to the surface in Montgomery county, and therefore take no part in the formation of its soils. The next overlying series, however, the rotten limestone, is here, as elsewhere, of great importance agriculturally, as being the basis of the prairie lands, which are among the most valuable in the county. The drift, however, with its red and yellow loams resting upon beds of sand and gravel, forms all the fine upland soils, which are interspersed with the prairie soils, and which prevail in the southern part of the county.

The greater part of the cotton, and indeed of all the crops, is made in the prairie belt and along the first and second bottoms of the river, and of the numerous streams flowing into it. These bottom lands are of great variety, some being stiff prairie soils, others light and sandy, and this applies as well to the bottom lands of the river itself, where the greatest variety may be seen. The abstract given below will show in detail the nature and characteristics of these various soils. In its agricultural features Montgomery very closely resembles Lowndes. The cotton, as soon as ginned, is hauled to the city of Montgomery, and there sold.

ABSTRACT OF THE REPORTS OF THOMAS W. OLIVER, OF MONTGOMERY, AND J. A. CALLOWAY, OF SNOWDOUN.

(The region reported upon lies, as to the lowlands, along the small streams tributary to the Tallapoosa river and along the waters of Ramer and Catoma creeks.)

The uplands are the rolling and level table-lands adjacent to these streams and the prairie lands, which occupy the lower levels in the same region. The lowlands are often overflowed, necessitating late planting of the cotton, which is thus liable to be destroyed by the caterpillar before it has had time to mature a crop. For this reason the uplands are generally preferred for cotton where the soil is at all suitable. The chief varieties of soil are the red lands, which are the upland loams, the post-oak and black-prairie soils, and the light-gray sandy soils lying between the red lands and the river bottom. This last occupies a narrow belt only. To these may be added the dark loam and the light sandy soils of the smaller streams above mentioned.

The most important of these soils is the prairie soil, which is found in patches over all the central portion of the county, and which is the main one of the black belt throughout the state. This soil occupies from a half to three-fourths of the area described, and has a natural growth consisting of post oak, hickory, hawthorn, wild plum, ash, etc. It has the usual heavy prairie soil of a gray to black color. The post oak or timbered prairie soil is often of a reddish color, and is thought to be the result of the admixture of the overlying loam with the calcareous matter of the Cretaceous rocks. On the black lands the subsoil is a jointed clay, white and chalky, overlying a blue marl. (*a*) The subsoil often contains lime nodules of irregular shape. When properly broken up, the soil, on exposure and drying, crumbles down and is very easily tilled, but in wet weather it is stiff and difficult to work.

The red-loam land is timbered with oaks, hickory, short-leaf pine, and the bottoms with poplar, gum, magnolia, etc. The soil is a sandy loam of different degrees of stiffness, and of colors varying from brown to red, according to the length of time cultivated. At 8 or 10 inches the color changes to that of the subsoil, which is generally a fine red loam, about one-third sand, friable when exposed, and darkening when mixed with vegetable matter. It contains occasionally rounded pebbles of quartz, and is underlaid with beds of sand and gravel, which, of course, rest at varying depths upon the country rock.

The sandy land, which occupies a narrow strip between the red lands and the river bottoms, has a growth of short-leaf pine and oaks, with water oak and sweet gum in the flats. The soil is a light loam, mostly sandy, of white, gray, and yellowish colors, and 4 to 6 inches deep to a change of color. The subsoil is nearly the same as the soil; if anything, more of a yellowish clay, with an admixture of coarse sand. Pebbles are found in the subsoil on slopes and elsewhere in places.

All these varieties are generally easily tilled in dry weather; but in wet weather the prairies especially are often quite difficult. The chief crops are cotton, corn, and oats, the sandy lands being suited to cotton and the prairie lands to corn and oats. From two-thirds to

a These terms allude to the varying aspect of the rotten limestone as it is disintegrated under the influence of the weather, the blue marl being the unaltered rock, and the joint clay, of chalky appearance, the same rotten limestone, broken and partially desiccated.—E. A. S.

three-fourths of the tillable land of all sorts is devoted to cotton, which is most productive when 3 or 4 feet high. In wet seasons, on fresh land, the cotton is inclined to run to weed. This may be prevented by an application of phosphates, to promote early fruitage. The seed-cotton product per acre on fresh land is from 1,000 to 1,200 pounds and 400 pounds on the sandy soil, and it requires from 1,600 to 1,660 pounds to produce a 475-pound bale. After forty to fifty years' cultivation without manure the average yield is about 500 pounds per acre; 200 pounds on sandy land. Burrs, morning-glory, and crab-grass are most troublesome. Very little land is turned out. Serious damage is sometimes done to hillsides by washing.

The various railroads which center in the city of Montgomery and the Alabama river furnish the means of transportation for all the products of the county. The city of Montgomery has always been one of the best cotton markets of the state, and receives the crop from many sections.

CRENSHAW.

(See "Oak and hickory uplands, with long-leaf pine".)

PIKE.

(See "Oak and hickory uplands, with long-leaf pine".)

BULLOCK.

Population: 29,066.—White, 6,944; colored, 22,122.

Area: 660 square miles.—Woodland, all except a few square miles of open prairie; prairie region, 300 square miles (200 of black prairie, etc., and 100 of hill prairie or Chunnenugga ridge); oak and hickory uplands, with long-leaf pine, 360 square miles.

Tilled lands: 176,860 acres.—Area planted in cotton, 80,470 acres; in corn, 47,441 acres; in oats, 6,177 acres; in wheat, 111 acres; in rye, 88 acres; in sugar-cane, 429 acres; in rice, 16 acres; in sweet potatoes, 773 acres.

Cotton production: 22,578 bales; average cotton product per acre, 0.28 bale, 399 pounds seed-cotton, or 133 pounds cotton lint.

Bullock county lies wholly within the Cretaceous region, and both the upper and lower subdivisions of this formation are concerned in the formation of its soils. In addition to this, the beds of the stratified drift are spread over all, modifying the soils, and in some cases forming them outright. The limit between the upper and lower divisions of the Cretaceous, running nearly east and west, falls near the center of the county, the precise position of this limit being very difficult to determine, because of the overlying drift.

Of the two divisions of the Cretaceous represented in this county (rotten limestone and Ripley), the former is not found south of the ridge upon which Union Springs is situated (Chunnenugga ridge). Beyond this to the southern line of the county the Ripley marls and limestone make the country. This ridge, which divides the waters flowing into the Tallapoosa river from those of Cowikee creek and Conecuh and Pea rivers, slopes gently away toward the south, but toward the north there is a rather abrupt descent into the prairie lands, which stretch thence northward to the county-line. Of the prairies there is little to be said in a general way more than has already been given under other counties, and the very full reports below will furnish all the needed details.

Chunnenugga ridge has a northeast and southwest direction, and is made up of beds of limestone, marl, clay, and sand. (*a*) In the calcareous clays resulting from the disintegration and intermixtures of these beds small white concretions of lime are abundant, and perhaps characteristic.

From the statistics it will be seen that this county ranks high in cotton production, and the following abstracts of carefully prepared reports which relate to all parts of the county will be read with profit by all who desire to have an acquaintance with the capabilities of the several soil varieties. The farmers, as a rule, sell their cotton as fast as baled to the merchants at Union Springs, and thence it is shipped by rail to the various markets. The rates to Montgomery and Columbus, Georgia, are about $1 50 or $2 per bale.

On account of the great variety exhibited in the agricultural features of Bullock county, I have given somewhat in detail the reports of correspondents from the different sections; and since the adjoining counties are in many respects similar, a repetition will not be needed in each case.

The greater part of the cotton crop is produced upon the calcareous lands of the upper part of the county, where the effects of constant (natural) marling are seen. In the brown-loam uplands, and their intermixtures with the sandier materials, we have nothing different, from an agricultural standpoint, from what may be seen in so many parts of the state.

ABSTRACT OF THE REPORTS OF W. M. STAKELY AND J. F. CULVER, OF UNION SPRINGS.

(This report relates particularly to the black lime-lands, partly bald prairie and partly timbered, lying north of Chunnenugga ridge, near Union Springs.)

The black lands alternate with the post-oak prairies, presently to be described, in such a way as to make it impossible to give any strict limits between the two. Taken together, they occupy a belt from 5 to 10 miles wide across the country, widening toward the west. The growth on the black uplands, which make about a fifth of the arable lands of Bullock county, consists of post oaks, interspersed with hickory, short-leaf pines, and other trees in small numbers, and an undergrowth of haw bushes, and is indicative of good cotton land. The heavy soil is a clay loam, sticky, and prairie-like in places, and of gray to black colors, according to the amount of vegetable matter present; thickness to a change of color, from 3 to 12 inches. The subsoil is commonly heavier than the surface soil, and consists of tough yellow and tough reddish clays. The sandy soils have sometimes a yellow sand as subsoil. These subsoils frequently have limy concretions, and are underlaid with a blue marl (rotten limestone) at 10 to 12 feet depth. In wet seasons this soil is difficult to till, because of its sticky nature; but in dry weather, when previously prepared, it is easy of tillage, and in general may be classed as an early, warm soil.

Cotton, corn, and oats are the principal crops produced, the soil being best suited to the first two, though three-fourths of the cultivated land is in cotton, which grows to a height of from 2 to 5 feet, being most productive at about 4 feet. Very wet weather causes the plant to run to weed, which is restrained by thorough drainage. The seed-cotton product of the fresh land is 800 pounds (1,425 to 1,545 pounds

a The marl and limestone contain the fossils characteristic of the Ripley group, and have furnished many of the newly-described fossils of this horizon.

to the bale of 475 pounds). The staple is good middling. After twenty years' cultivation the yield is 500 pounds, with a slightly shorter staple and slightly less lint. Crab-grass and morning-glories are the most troublesome weeds. At present very little of this kind of land lies turned out, and when it is reclaimed it produces well the first year and better afterward. There is some slight damage from washings; but the valleys are not much injured by the washings from the uplands, and efforts made by hillside ditching to check it have met with moderate success.

ABSTRACT OF THE REPORT OF J. L. MOULTRIE, OF UNION SPRINGS.

(Relates more particularly to the post-oak lands or timbered prairie lying upon the headwaters of Cuplahatchee creek, a tributary of the Tallapoosa river.)

The prevailing growth is post oak, short-leaf pine, with some hickory, red oak, and black-jack on hills; in the bottoms, poplar, elm, gum, ash, shell-bark hickory, and some walnut. The light soils are fine loams; the heavier, more clayey; colors, gray red to nearly black. Thickness to change of color, 3 to 6 inches; in the bottoms, 1 to 2 feet. Subsoil mostly red-joint clay; sometimes a yellow marly clay. On sandy hummocks the clay is yellow and mixed with mica, and is underlaid with blue or greenish marl; on sandy hummocks, sometimes pebbles, about 13 feet from surface, and only about 6 inches deep. A blue marl underlies the subsoils at a depth of about 25 feet. In wet weather the soil is rather difficult to till, as it becomes sticky, and it is always heavier than the sandy land. The soil is naturally well drained, even in bottoms, and is early and warm. Cotton, corn, oats, and sweet potatoes are the chief crops. The thin gray and clay lands are best suited to cotton, the deep black land to corn and oats, and the white bald prairie to corn.

Fully three-fourths of the land is put in cotton. The stalk grows from 2 to 5 feet, being most productive at 4 feet. In wet seasons, and on moist and alluvial lands, the plant sometimes runs to weed. One of the remedies suggested is to plant every second or third row in corn or break the land very shallow. The average seed-cotton product per acre of fresh land is 800 pounds (1,545 pounds to a 475-pound bale), and the staple is middling. Twenty-five years' cultivation will reduce the yield to 500 pounds, with staple perhaps about an eighth of an inch shorter than that of the fresh land; the seeds are also less, which makes the proportion of lint and seed about the same. Crab-grass gives the most trouble, and morning-glories late in the summer in the black lands. Yellow-dock is troublesome if it ever gets a hold. None of this land lies turned out, except for want of labor to cultivate it, and from this cause probably one-twentieth is idle. If neglected, this soil is likely to be injured from gullies. The valleys are not hurt unless the washings are clay. Hillside ditching is sometimes practiced with good success.

ABSTRACT OF THE REPORT OF M. L. STINSON, OF UNION SPRINGS.

(Refers chiefly to the sandy and loamy soils making the bottoms and uplands upon the waters of Conecuh and Pea rivers and their tributaries.)

The soil varieties described are derived from the loams and other drifted materials of the post-Tertiary formation, and vary in accordance with the varying proportions of sand and clay. The varieties enumerated are: First, loam lands, with growth of short-leaf pine, oaks, and hickory; second, loam lands, with black-jack as the characteristic growth; and third, sandy lands, with prevailing timber of long-leaf pine and black-jack oak. The lower part of the county south of Union Springs is made up of these lands, the sandy pine lands occupying about half the territory, the other two varieties the balance. The oak uplands have, in addition to the growth above named, chestnut, beech, poplar, elm, magnolia, cottonwood, cucumber, dogwood, maple, walnut, etc. The soil varies from a fine sandy to a stiff prairie-like consistence where the marls of the Cretaceous are near enough to the surface to be felt; thickness to a change of color, 1 to 6 inches. The subsoil, from 6 to 18 inches, is a stiff yellow clay or dark yellowish sand, containing occasionally rounded pebbles of quartz. Below the subsoil, clay and sand to the marl, at an average depth of 30 feet. The black-jack land sustains a growth of pine, hickory, black-jack, and post oaks, some chestnut, chincapin, sloe, etc., and has a soil chiefly sandy, 2 inches deep, with subsoil of yellowish sand, containing pebbles, and from 2 to 8 feet deep. The underlying rock, at depths of 40 or 50 feet, is the marl above alluded to. The two soils seem to differ only in the depth from the surface of the clay and upon its quality.

The third variety of land supports a growth of long-leaf pine and black-jack oak, and needs no further description, as the same quality of land has been frequently the subject of remark, and the pine woods, wherever found, bear approximately the same character.

Agriculturally, the loamy and sandy lands are of easy tillage, and are all warm and well drained. The prairie lands are considerably earlier than any of the sandy lands, and cotton grows much more rapidly on the strong limy lands. The usual crops are produced upon all these lands, the stiffer clayey lands being best suited to cotton, and the sandy to corn and pease. About half the cultivated area of the first two and about a third of the pine land is in cotton. The height of stalk varies greatly, but the higher the better for yield. When the plant runs to weed, which it does sometimes when left too thick, more room is given. The maximum yield of seed-cotton on fresh land is from 1,000 to 1,300 pounds for first quality, 800 for the second, and 600 for the pine lands, and 1,545 pounds is about the average for a 475-pound bale. The staple rates from middling to strict middling. Ten years' cultivation will reduce the yield, on an average, 20 per cent., and on some of the lighter lands even more. The staple from worn land is somewhat shorter than that from fresh, and rates a grade less on the average. Crab-grass is the most troublesome of the weeds, except the Florida purslane (*Richardsonia*) in the piny woods. Not much of the originally cultivated land lies turned out, except for lack of labor to cultivate it. The pine land has not been cleared up much. The better qualities do very well when reclaimed, but the worn pine lands are not considered worth the trouble of reclaiming. The loam lands, because of their uneven surface, are liable to injury from washing; but the pine lands are mostly level. Hillside ditching is practiced with very good results.

MACON.

Population: 17,371.—White, 4,587; colored, 12,784.

Area: 630 square miles.—Woodland, all. Gravelly hills, with long-leaf pine, 330 square miles; prairie region, 260 square miles; metamorphic region, 40 square miles.

Tilled land: 133,924 acres.—Area planted in cotton, 56,763 acres; in corn, 23,833 acres; in oats, 6,195 acres; in wheat, 1,916 acres; in rye, 45 acres; in sugar-cane, 140 acres; in sweet potatoes, 928 acres.

Cotton production: 14,589 bales; average cotton product per acre, 0.26 bale, 372 pounds seed-cotton, or 124 pounds cotton lint.

The geological and agricultural features of Macon county are, in great measure, similar to those of its neighbor on the east, Russell. In the extreme northern part of Macon county the metamorphic or crystalline rocks make the substratum of the country. These are generally covered by the superficial deposits of a much more recent period, and seldom take any prominent part in the production of the soils. The line of contact of these rocks with those of the Cretaceous formation is everywhere hidden by these surface beds, and it is only south of Tuskegee that the Cretaceous strata have been recognized. The black Cretaceous prairie soil does not appear over any considerable area until the southern limit of the county is nearly reached, within 7 miles of Chunnenugga ridge (Tuomey).

The remarks of Professor Tuomey upon the soils of this part of the county are of sufficient value to be presented at this point again. In speaking of the area formed by the rotten limestone, he says: "The surface is undulating and covered with black and yellowish soils. The bald spots are covered with ash-colored soils. The whole of the limestone near the surface is broken up by laminæ and joints, but yet contains fossils in place and numerous concretionary nodules of lime so white as to resemble caustic lime. This stratum is about 20 feet in thickness; this is called by the well-borers 'clay', and is the limit of the sipe-wells. The water, percolating through the fissures, furnishes these wells. Under this the rotten limestone assumes its usual characteristics. Near Town creek a good opportunity was afforded of seeing the junction of the post oak and ordinary soil of the prairie." At this place Professor Tuomey observes: "1. The fissured rock mentioned above, which is found on all the bald spots. 2. The sudden termination of the preceding stratum as if it were washed away by water. 3. A bed without fossils, which appears to be an accumulation of lime and clay with organic matter, deposited after the removal of a portion of the fissured rock, the subsoil of the post-oak soil."

From these passages it seems that the post-oak soil is the result of the reaction of the limy materials of the Cretaceous beds upon the loams of the overlying and more recent formation, while the ordinary prairie soils are the result of the disintegration of the rotten limestone itself. The fact that soils in many respects analagous to the post-oak soils are to be seen where the calcareous rocks of the Tertiary have, after disintegration, mingled with the overlying loams gives additional force to the view advanced by Professor Tuomey.

A short distance east of the town of Tuskegee the beds of drift are well displayed. These consist of 20 or 25 feet of light-colored micaceous sands with cross bedding, above which are about 4 feet of reddish sand, and over this 10 feet of the white, all capped by the reddish, irregularly stratified beds of sand, clay, and loam of the usual type of the stratified drift. Of course, with such thickness of overlying strata, the Cretaceous rocks rarely have much to do with the soils.

In the southeastern corner of the county the sandy ridge, with substratum of bluish marl, which is so prominent a feature of Bullock county, occupies a small area. Upon this ridge the soils are sandy and loamy, but beyond it come the peculiar soils of the Cowikee lands, already fully discussed under Russell and Barbour.

The creeks which traverse Macon county have in many instances cut their channels through the surface-covering of drift, and the soils along the lowlands thus formed frequently differ very considerably from those of the adjacent uplands. Caleebee creek, from its source to its mouth, passes through a rich country with dark soil, derived from the rotten limestone and other Cretaceous rocks. The same may be said of Cupiahatchee creek. The uplands on and near both the streams have mulatto soils with a growth of oaks and hickory. Eufaupee creek for 20 miles from its mouth flows through a country with yellow sandy soil and a stiff yellow clay below, containing usually a good deal of yellow and white quartz pebbles. Big Swamp creek traverses a rich section of the county. The soil is dark and very productive. Chewacla creek passes generally through piny woods, but cuts through the surface beds, and the bottom soils are in places dark blue and very productive. The pine land is poor.

Agriculturally, Macon county enjoys several advantages over its western neighbors on the pine-hills belt, for in the southern part of the county the underlying calcareous rocks are exposed, and in the eastern the same is true of the blue marl, as it is called. Both these underlying formations exercise a very beneficial influence upon the prevailing sandy loams, which are marled more or less thoroughly by such intermixtures.

ABSTRACT OF THE REPORT OF JOHN L. COLLINS, OF TUSKEGEE.

The soils are the varieties above enumerated. Those of the uplands are generally sandy loams, of yellowish to light colors; those of the bottom vary with the locality, being clay loams, and in places are prairie-like. The subsoils, mostly somewhat heavier than the top soils, often consist of yellow or red clay, and in most of the county are underlaid with sand, which often contains pebbles. The soils are easy of tillage, except when wet. The chief crops are cotton, corn, oats, rye, wheat, etc., and the lands are about equally well adapted to each.

Two-thirds of the cultivated land is in cotton, which on good land attains a height of 4 feet; on poor land, 18 inches to 2 feet. In wet seasons there is sometimes a tendency to run to weed, for which no remedy is suggested. When the land is fresh the seed-cotton product per acre is from 700 to 1,000 pounds, of which about 1,425 pounds go to make a standard bale of 475 pounds. The staple rates as low middling. After five years' cultivation, without manure, the yield is one-third less on the uplands. On the bottoms there is no perceptible change in either the quantity or quality of the yield. Crab-grass is much the most troublesome of the weeds. Perhaps a third of the land originally cultivated now lies turned out, but when again taken into cultivation it yields about a third less than when fresh. On slopes all this land washes badly, and the injury to the uplands is considerable, but the bottoms are, if anything, benefited thereby. Occasionally efforts have been made to check this by horizontalizing, etc., and with very fair success.

Shipments of the cotton crop are made chiefly in October and November, by rail, to Montgomery, at the rate of $1 30 per bale.

RUSSELL.

Population: 24,837.—White, 6,182; colored, 18,655.

Area: 670 square miles.—Woodland, all. Pebbly hills with pine and oak uplands with pine, 370 square miles; blue-marl lands, 300 square miles.

Tilled land: 134,320 acres.—Area planted in cotton, 81,582 acres; in corn, 34,335 acres; in oats, 9,789 acres; in wheat, 1,099 acres; in rice, 65 acres; in sugar-cane, 196 acres; in sweet potatoes, 1,093 acres.

Cotton production: 19,442 bales; average cotton product per acre, 0.24 bale, 342 pounds seed-cotton, or 114 pounds cotton lint.

Russell county, though underlaid with the strata of the Cretaceous formation, depends for its soils in great measure upon the thick beds of the stratified drift, which cover the whole county to a greater or less degree. The great drift bed which borders the older formations of the state crosses this county from east to west, and covers the northern half. The water-shed between the Tallapoosa and the Chattahoochee, which is the continuation of the Chunnenugga ridge of Bullock county, enters Russell near the middle of its western boundary. Its further course northeastward toward Columbus has not been definitely traced out, but it is probable that it is soon merged into the great pebble belt previously mentioned. Northward of this ridge occasional patches of the black prairies of the

rotten limestone are met with where the overlying pebbles and sands have been removed by denudation. The prairies, however, are in detached bodies, and do not form large tracts, as is the case to the westward.

Southward and southeastward of the water-shed previously mentioned the beds of marl, etc., of the Ripley group are often exposed by the removal of the drift deposits, and the reaction of this marl upon the overlying loams gives rise to the peculiar soils of Cowikee creek. Some of the characters of this class of soils have been given under the head of Bullock county, and vary from a stiff to a rather sandy clay, the lighter soils being found generally on the north side of the streams. Local patches of a tenacious clayey soil, called "hog-wallow prairie", are here and there met with in the Cowikee lands. The timber throughout this region is a mixture of long-leaf pine, with hickory, white and Spanish oaks, and sweet and sour gums and maple in the bottom lands. The hog-wallow clay in dry weather packs very much after the fashion of the prairie soil of the rotten limestone, but the colors differ, being reddish here, and grayish or grayish-yellow in the rotten limestone. The low, heavy lands of the Cowikee alternate with light sandy soils upon the hillsides and divides, and occasionally beds of deep white sand are encountered, which remind one of the pine barrens of the extreme south. The presence of an unusually large proportion of mica in the drift sands has been mentioned under Bullock county, and the same thing may be noticed in this county also.

A line drawn diagonally through the county from northeast to southwest would approximately separate the rotten-limestone lands from those of the Ripley marls. The former are found only in detached bodies among the greatly preponderating loams and sands of the overlying drift, while the latter are quite characteristic of the region in which they occur.

From what has been said, it will not be difficult to understand the variety and distribution of the soils as they occur in Russell county, being the sandy and loamy soils of the post-Tertiary deposits on the one hand, and the heavy black-prairie soils of the rotten limestone and the stiff, clayey to light sandy and marly soils of the Ripley group on the other. Most of these soil varieties have already been fully described.

The high rank of Russell county in cotton production is due chiefly to the cultivation of the lands in which the blue marl, as it is called, forms the substratum. The intermixture of the blue marl with the overlying loams has the effect of stimulating the latter to its utmost capacity.

The cotton crop is usually sold to the merchants at the various railroad stations in the county, and thence shipped to the various markets north and east.

BARBOUR.

Population: 33,979.—White, 13,091; colored, 20,888.

Area: 860 square miles.—Woodland, all. Oak and hickory uplands, with long-leaf pine, 610 square miles; blue-marl lands, 250 square miles.

Tilled land: 197,455 acres.—Area planted in cotton, 100,442 acres; in corn, 61,822 acres; in oats, 10,264 acres; in wheat, 131 acres; in rye, 112 acres; in rice, 35 acres; in tobacco, 22 acres; in sugar-cane, 647 acres; in sweet potatoes, 1,274 acres.

Cotton production: 26,063 bales; average cotton product per acre, 0.26 bale, 372 pounds seed-cotton, or 124 pounds cotton lint.

A line drawn east and west through Barbour county near the center will divide it into two parts, which are quite dissimilar. The soils on the north of this line are more or less calcareous, those on the south sandy. The northern half has a substratum of marl and limestone of the Upper Cretaceous formation (Ripley group), which, acting upon the soil, gives rise to some of the best and safest cotton lands in the state. This portion of the county is drained by the three forks of Cowikee creek, and is known throughout the county as the Cowikee lands. The soil is a moderately stiff calcareous clay, with patches of what is known as hog-wallow, which are seldom more than an acre or two in extent. In the immediate vicinity of the streams the soil is much more sandy, but highly productive. The general appearance of these lands is that of a gently undulating, occasionally hilly region, somewhat resembling the prairies of the rotten-limestone country, but with reddish or light-colored soils. This region, though fertile, is malarious, and is inhabited by comparatively few white families. The negroes, however, appear to endure it very well. There is a peculiar mixture of trees characterizing these lands, viz: hickory, white and Spanish oaks, sweet and sour gums, and long-leaf pine. The latter appears out of place with such surroundings.

Upon the divides in the Cowikee region the strata of the post-Tertiary are found, consisting of sands, clays, and pebbles, with the usual irregular stratification. These beds throughout the county show a larger proportion of mica than is usually seen; a fact which may possibly find an explanation in the nearness of the metamorphic area of the state. The soils produced by these surface beds are of the same general nature with similar soils in other parts of the state, varying from the extremes of sandy to clayey, and supporting a correspondingly varied growth—long-leaf pines upon the sandier and the various species of oaks upon the more loamy portions.

The southern half of the county is underlaid generally with the beds of the Tertiary formation, but these are seldom concerned in the formation of the soils, since they are covered with the sands and loams of the stratified drift. Upon occasions the Tertiary beds approach the surface and bring about modifications of the soil. Taken as a whole, however, the soils of the southern half of Barbour are deficient in lime and generally sandy, and the country high and rolling, and good freestone water is attainable by wells from 20 to 30 feet deep. This land is not specially suited to cotton, though the free use of fertilizers will always produce a satisfactory yield. In places where the overlying drifted materials have been partially removed the calcareous and greensand beds of the Tertiary give rise to the formation of local tracts of very fine soil, similar in all respects to those mentioned under Pike county.

The Chattahoochee river forms the eastern boundary of the county, and the bottom lands of this stream are from 1 to 3 miles wide, and very productive. Next to these are the second bottoms or hummocks, or pine flats, always safe and easy to cultivate. Bordering upon these are the foot-hills of the pine uplands.

Although the larger part of the surface of this county is occupied by brown loams, with a growth of oak, hickory, and pine; yet the characteristic agricultural features of Barbour depend upon the blue marls of the Cowikee and other drainage areas of the northern half of the county. A large proportion (more than half) of the cotton crop is produced in the northeastern part of the county, where these marls give character to the soils. There is

perhaps no part of the state which ranks higher in the production of cotton than the blue-marl lands of adjacent parts of Russell, Barbour, and Bullock counties, whose prevailing soils are light sandy loams, easily worked, possessing a comparatively high percentage of lime, by which they are rendered extraordinarily thrifty.

ABSTRACT OF THE REPORTS OF JUDGE H. D. CLAYTON, OF CLAYTON, AND DR. H. HAWKINS, OF HAWKINSVILLE.

(The region reported upon lies at the headwaters of Choctawhatchie river, and includes both uplands and lowlands; also, the Cowikee lands are described.)

No local causes influence the growth of cotton in the former region, but in the Cowikee lands the heavy dews are thought to be favorable to the growth. The upland soils are gray to red in color, and mostly sandy and porous. The gray lands are about three-fourths and the red about one-fourth of the area. The growth upon the gray land is a mixture of long-leaf pine, red, white, and post oaks, and hickory, and that on the red land the same, with the addition of walnut, persimmon, grape-vines, chincapin, buckeye, etc. The red soil is usually much stiffer than the gray, and has a subsoil of sometimes very hard clay and sand, underlaid frequently with a hard-pan at a depth of several feet.

These soils are of easy tillage at all times, and produce the usual crops, being, however, best adapted to grain, potatoes, and pease, although cotton forms at least half of the cultivated crops. The most productive height of stalk is about 3 feet. In wet seasons, and on fresh land, the plant sometimes runs to weed, but this may be checked by the free use of commercial fertilizers and by topping. The seed-cotton product of the fresh land is given at 1,000 pounds (one-third lint), this average yield of lint being estimated from the observation and experience of thirty years. The staple rates high in the market (exact grade not given). Cultivating 3 to 4 years without manure will bring down the yield to 500 pounds with a little shorter staple. Coffee-weeds are more troublesome than any other, but none will give trouble where the crop is properly worked. About a fourth of this kind of land lies turned out, chiefly because since the war the negro laborers cannot be induced to care for the land and keep the ditches cleared out either on hillsides or in the bottoms unless especially hired for the purpose, and this takes too much money from the owner of the land to justify him in so doing. On some farms, where the negroes have become attached to the place, they can by a little coaxing be induced to keep up the land.

When turned out for 10 or 15 years and grown up in old-field pine lands will produce nearly as well as the fresh lands when reclaimed. A great deal of injury is done both to the hills and the valleys by washings and gullies. When the hillsides are turned out and grow up in the pines, the valleys are improved, there being no washings from above.

The soil of the Cowikee lands is a fine sandy loam, alternating with a heavier, clayey, sometimes prairie-like loam, both more or less strong in lime. The color is usually gray or yellowish, and the subsoil is also of light color. The common growth is oak, hickory, and long-leaf pine. The three branches of Cowikee creek flow together before reaching the river. On the north side of each the land is comparatively level, and the principal growth pine; the soil, light-gray, chincapin, and hog-wallow. On these the cotton is small but very prolific, though most subject to rust after the land has been cultivated for a few years. On the south side of these streams the land is much stronger, with more lime, and produces a large cotton weed; it is also better for corn.

In wet seasons the land is rather difficult to till, but yields fine crops. Cotton occupies four-fifths of the cultivated land, and the height of stalk at which it is most prolific is from 3 to 4 feet. In wet weather the plant inclines to run to weed, but the application of commercial fertilizers will usually check this. The seed-cotton product of the fresh land is from 1,000 to 1,200 pounds, one-third lint, and the staple rates high in the markets. Six years' cultivation will bring down the yield to between 400 and 600 pounds. When properly cultivated, weeds give no trouble. About 10 per cent. of the land lies out, but it does well when reclaimed. The soil washes badly on slopes, and the valleys are injured, often to the extent of 10 per cent., by the washings from the uplands. Some slight efforts have been made to check the damage by horizontalizing, hillside ditching, etc., and with good success.

Shipments of the cotton crop are made throughout the season, usually by railroad, to the eastern markets. From Clayton the rate to Eufaula is $1 per bale; distance, 20 miles.

THE FLATWOODS BELT.

This comprises a narrow strip running through the counties of Sumter,* Marengo,* and Wilcox.*

SUMTER.

(See "Central prairie region".)

MARENGO.

(See "Central prairie region".)

WILCOX.

(See "Oak and hickory uplands, with long-leaf pine".)

OAK AND HICKORY UPLANDS, WITH LONG-LEAF PINE.

This region comprises wholly or in part the following counties: Sumter,* Choctaw, Clarke, Monroe, Wilcox, Butler, Conecuh, Covington,* Crenshaw, Montgomery,* Bullock,* Barbour,* Pike, Coffee, Dale, and Henry.

SUMTER.

(See "Central prairie region".)

CHOCTAW.

Population: 15,731.—White, 7,390; colored, 8,341.

Area: 930 square miles.—Oak and hickory and long-leaf pine uplands, 830 square miles; lime-hills, 100 square miles. Of the former, 475 square miles are long-leaf pine uplands and 355 square miles brown-loam uplands.

Tilled land: 77,182 acres.—Area planted in cotton, 31,086 acres; in corn, 25,613 acres; in oats, 3,338 acres; in rice, 38 acres; in sugar-cane, 101 acres; in tobacco, 23 acres; in sweet potatoes, 748 acres.

Cotton production: 9,054 bales; average cotton product per acre, 0.29 bale, 414 pounds seed-cotton, or 138 pounds cotton lint.

In Choctaw county the rocky substratum is made by the various beds of the Tertiary formation, and while these underlying older rocks have been covered with deposits of sand, pebbles, and loam of a later period, yet they are in many places sufficiently near the surface to modify the soils, and in some instances to form them outright. On account of the slight southward dip of the Tertiary beds, we find the lowest and oldest of these in the northern part of the county, while the later beds appear at the surface in succession as we go southward.

Throughout the county the higher levels of the table-lands have the brown loam to gray sandy soils of the drift deposits before named; but where these have been removed, as upon the slopes and on the borders of the lowlands, then the Tertiary rocks come to light and produce many decided soil varieties. The lowest Tertiary beds occurring in Choctaw county consist of laminated clays, usually of grayish colors, which are interstratified with sandy strata containing great numbers of marine shells, constituting marl beds. These beds occur as far south as the latitude of Butler, and, where they take part in the formation of the soils, give rise to heavy clayey soils on the one hand and to stiff calcareous loams on the other. About Butler may be seen lime-hills of this character. The growth on these hills consists chiefly of post oak, hickory, and short-leaf pine, with a few oaks of other species. Most of these trees are draped with long moss. Where the overlying sandy loams are thick the long-leaf pine becomes abundant, and on most of the sandy plateaus it is the prevailing tree.

The next division of the Tertiary, which makes its appearance south of Butler in a belt extending to Bladen Springs, is made up of aluminous sandstones and claystones, which overlie beds of dark-colored clays, interstratified with beds of greensand marl. Where the sandstones are prominent the topography is quite varied, and consists of high, steep hills, with deep, narrow ravines. The soils which depend upon this material are naturally poor, and the timber is mostly of long-leaf pine, black-jack, and high-ground willow oaks; but the calcareous deposits previously mentioned give rise to very good limy soils, where sufficiently large tracts of land level enough for cultivation can be found. In all this section between Butler and Bladen Springs the creek bottoms appear to be very productive and to contain a considerable proportion of lime, as may be inferred from the luxuriance of the vegetation and the prevalence of the spruce pine, which seems to be a lime-loving tree. The uplands between these streams have the usual sandy loam soils, and in some places the sandstones themselves form the soils, which are then almost worthless for cultivation.

South of Bladen Springs (the waters of which, like those of Tallahatta Springs, on the other side of the river, come from the Tertiary rocks just described) the country is formed of the strata of the Jackson and Vicksburg groups of the Tertiary, and are either calcareous clays, marine shell deposits, or white limestone. In places, particularly along the usually very steep slopes bordering the streams, the calcareous beds, and especially those of slight coherence, mingle with the materials of the overlying deposits, and produce the peculiar soils of the lime-hills. These vary from a stiff, limy red loam to a black soil very much like some of the soils of the central prairie belt. Unlike these, however, the lime-hill soils appear in this county only in comparatively limited patches, and the region of their occurrence has the prevailing characters of the pine uplands, the calcareous soils forming only a small proportion of the total area.

From Mr. James Hamrick, of Isney, I learn that the belt of what is called in this county "shell prairie" is about 5 miles wide, and enters the county in township 11, range 5 west, and passes southeast, leaving the county in township 9, range 3 west. These and the creek bottoms form the very best lands in the county.

All the divides and high lands of the southern part of the county have rather thick beds of drift and loam overlying the Tertiary, and the agricultural features are hence mostly independent of the latter, except along the drainage slopes.

It will be seen from what has been said that while the prevailing character of Choctaw county is that of the long-leaf pine uplands with oak and hickory, yet the most productive lands, and those which are of most importance to the cotton-planter, are the shell prairie and creek bottoms. In the adjoining counties of Clarke and Wayne, in Mississippi, the shell prairies are of the same nature, though, if anything, rather more widely distributed, and in larger bodies.

The Tombigbee river on one side of the county, and the Mobile and Ohio railroad, in Mississippi, on the other, furnish the only means of transportation for the products of the county to the distant markets.

CLARKE.

Population: 17,806.—White, 7,718; colored, 10,088.

Area: 1,160 square miles.—Woodland, all. Lime-hills, 560 square miles; oak and hickory and long-leaf pine uplands, 340 square miles, of which 100 are brown-loam uplands and 240 long-leaf pine uplands; rolling and open pine woods, 260 square miles.

Tilled land: 77,186 acres.—Area planted in cotton, 33,477 acres; in corn, 28,220 acres; in oats, 5,065 acres; in tobacco, 19 acres; in sugar-cane, 200 acres; in rice, 22 acres; in sweet potatoes, 1,256 acres.

Cotton production: 11,097 bales; average cotton product per acre, 0.33 bale, 471 pounds seed-cotton, or 157 pounds cotton lint.

The position of Clarke county, in the angle of the Alabama and the Tombigbee rivers, is favorable to the production of a diversified topography and to the exposure of its rock structure; hence the study of its natural features is of the greatest interest. The Tombigbee receives by far the greater part of its surface drainage, for the

divide between the two rivers runs within 10 miles of the Alabama river the whole length of the county. It thus follows that its principal creeks—Bashi, Tallahatta, Satilpa, Jackson's, and Bassett's—flow west or southwest diagonally across the county. The rock strata have a gentle dip southward, and to this relation between the directions of the streams and the dip of the rocks is due one of the striking topographical features of the county, viz: that escarpments or abrupt hills are found on the southern or southeastern borders of these streams, while to the north and northwest the slopes are very gradual, often almost imperceptible.

The Tertiary strata which form the substratum of Clarke county have been covered with beds of sand, pebbles, and red loam, and the altitude of the main water-sheds, which are, in general, plateaus covered with these drifted materials, is about 500 feet above tide. The greater part of the original surface has been irregularly worn away by erosion, and especially is this the case in the lower part of the county, where the two rivers are not more than 6 or 10 miles apart. Both the Tertiary strata and the drift beds overlying them have contributed to the formation of the soils of the county, but in very unequal proportions, since the drift occupies the greater part of the surface.

The high hills which overlook and form the southern border of the drainage area of Tallahatta creek are caused by hard sandstones and claystones perhaps 200 feet in thickness. These rest upon dark-colored laminated clays and sands, which form their lower parts, and underlie also the whole region north of them to the line of Marengo and beyond. The Tallahatta hills, as they may be called, are rough and rocky, and have in general poor, sandy soils, upon which long-leaf pine and black-jack and high-ground willow oaks form the principal timber. Where the streams have cut down through these sandstones into the underlying strata the soils are often of much better character, for reasons which will appear hereafter. Usually in the region of these hills there are no good soils, and the country is very sparsely settled. Cattle, however, find very good pasturage.

North of the Tallahatta hills the lignitic clays and sands form a much more level country, whose soils, while in a great measure derived from the overlying drift beds, are nevertheless in places greatly modified by intermixtures with these older rocks. Interstratified with the clays and sands are one or two beds of shell marl containing a notable amount of greensand, and where these come to the surface a great improvement in the soil may be noticed. This improvement is most strikingly seen in the lime-hills, a belt of which crosses the county nearly east and west through Choctaw corner. The limy tracts are not always continuous for long distances, but are rather in detached bodies, except eastward near the Wilcox line, where they become characteristic. The hills are usually very steep, and the soil, in consequence, washes badly, and when left out of cultivation soon becomes disfigured by unsightly gullies. The timber is chiefly beech, but with it are many other trees, such as hickory, white oak, sweet gum, short-leaf pine, spruce pine, etc.

Southward from the Tallahatta hills (leaving out of account the superficial drift beds) the whole county is formed of beds of white limestone of varying degrees of purity, which are interstratified with thinner beds of loose shell marl. These rocks and marl beds, with one principal exception, do not play any very important part in the formation of the soils. This exception is found in the lowermost of the limestone beds, which is impure and clayey, and in places is almost a calcareous clay. Wherever this rock occurs as the surface formation, or where the surface materials are affected by it, it gives rise to a series of peculiar soils which characterize the lime-hills and shell prairies. The varieties of soil depending on this rock alone are of two kinds: a loose, black material, and a gray, waxy clay, which becomes black on the addition of vegetable matter. A mixture of this gray clay with the red-drift loam produces a stiff yellowish or mahogany soil, difficult of cultivation, but very fertile. These soils and their characteristic vegetation have been somewhat fully described in the general part (page 52).

It would be a mistake to suppose that the prairie or lime soils form the majority of the tillable lands, even where they give character to the country. The great proportion of all the soils is derived from the surface loam previously spoken of, and the limy soils are seen usually in small detached bodies, mostly at lower levels, where the superficial beds have been removed by denudation. This limestone is the matrix of the huge bones which have been found from time to time in Clarke county. Associated with it are also beds of gypsum, which is found occasionally in crystallized form in great quantities imbedded in clay. This gypsum might be profitably employed upon the lands of the sections where it abounds. The lime-hills occur from the latitude of Coffeeville southward as far as the vicinity of Barlow bend, or over three-fourths of the county. In many places the bare white rock is exposed in great bodies, as about Clarkesville, Suggsville, Cedar creek, etc.

The other limestone beds which overlie the one just described play an important part in the topography, but are not so generally concerned in the production of a peculiar soil as is the former. It is seen in a great bluff at old Saint Stephens. Portions of it, when freshly quarried, are quite soft, and are easily cut into blocks, which are used in the construction of chimneys. The thin beds of shell marl which are associated with these rocks have a local effect upon the soils. Some of them could be profitably employed on the lands which lie contiguous, but they are not generally rich enough to be shipped to distant points. An exception might be made in the case of the marl bed which occurs at the Claiborne landing, in Monroe county, and which is seen at several points on the Clarke county side. This is a shell marl, which in places contains very little else than shells, and might pay to ship. Some of the more level areas, where the limestone lies beneath the surface, are marked with shallow depressions, or lime-sinks; but this feature is not a common one in Clarke.

Of the soils produced by the surface beds of the drift it does not seem necessary to speak at this place, since they have been fully treated of in the general part of this report. All the table-lands and many other areas in Clarke have the loam soils, many of which are of excellent quality. The pebbles which so commonly underlie the surface loams usually make their appearance along the hillsides, where the table-lands break off toward the water-courses. They may be seen, for instance, about the towns of Jackson and Grove Hill, and in many similar positions.

On the water-shed between Bassett's creek and the Alabama river there are places where the gullies have encroached on each side upon the hills until only a narrow ridge now remains of the dividing plateau. From this ridge the view is unobstructed on each side, and embraces the whole width of the drainage areas of the two streams.

With reference to its prevailing timber growth, this county may be divided into several distinct belts. The northern belt is a region of oak uplands, with long- and short-leaf pine. Interspersed with these uplands are the lime-hills, with beech timber and the peculiar growth which generally characterizes bottom lands. South of this come the Tallahatta hills, occupying a belt 10 miles in width, timbered with long-leaf pine and black-jack; thence

southward, to the lower limit of the county, are alternations of oak and hickory uplands and long-leaf pine forests, the latter increasing in extent in the same proportion that the former decrease, till below Grove Hill the country has the characters of the pine uplands and rolling pine lands. Within this region are the lime-hills and shell prairies of the white limestone.

The cotton lands of Clarke county are the second bottoms or hummocks of the two rivers, and are often several miles in width, with sandy loam soils, in many cases strengthened by the washings from the calcareous uplands. The creek lands are not so generally desirable, for on the north side the soils are nearly always too sandy. On the southern side, where by reason of the marly beds the soils are often of a very superior character, the surface is usually very broken, and it is possible to cultivate only small patches; such, at least, is the case with the principal streams. The small creeks which flow into the Alabama river have generally very little bottom lands, and often steep, rocky banks. The lime-hills, both north and south of the Tallahatta hills, produce fine crops, especially the loose, black-shell prairie of the latter. The upland soils of the red loam have the same character in this county as elsewhere, and are some of the best and safest of the cotton lands.

Clarke county depends upon the two rivers for shipping its cotton to market, and the most of it goes naturally to Mobile. The freight to that point is from $1 25 to $1 50 per bale.

MONROE.

Population: 17,091—White, 7,780; colored, 9,311.

Area: 1,030 square miles.—Woodland, all. Undulating pine lands, 380 square miles; pine uplands, 250 square miles; brown loam or oak and hickory uplands, 130 square miles; lime-hills, 270 square miles.

Tilled land: 77,317 acres.—Area planted in cotton, 33,463 acres; in corn, 24,135 acres; in oats, 4,597 acres; in rice, 78 acres; in sugar-cane, 329 acres; in tobacco, 11 acres; in sweet potatoes, 920 acres.

Cotton production: 10,421 bales; average cotton product per acre, 0.31 bale, 441 pounds seed-cotton, or 147 pounds cotton lint.

In its geological structure Monroe county closely resembles Clarke, which adjoins it on the west. The underlying rocks throughout the county are those of the Tertiary formation, the aluminous and siliceous sandstones of the buhr-stone group occurring in the northern part of the county, while the white limestone underlies all the southern part. But the beds of sand, pebbles, and loam belonging to the stratified drift formation are spread over all these older rocks, and are concerned in the formation of the greater part of the soils.

The sandstones above mentioned form a hilly and much broken country, with poor sandy soils, on the uplands; but as the sandstones are underlaid with a dark-colored laminated clay interstratified with beds of greensand marl the valleys lying at the foot of these hills are often very productive. The whole of this region is characterized by rough, precipitous hills with long-leaf pine growth, alternating with fertile limy valleys. Notwithstanding the broken character of the country, some of the most prosperous farmers are located in this section.

In the central and southern parts of the county the topography is comparatively little influenced by the underlying rocks, and the uplands have the prevailing characters of the pine hills or rolling pine lands, and similarly with the soils, which are for the most part the sandy loams derived from the drift, present no peculiarities. Where, however, these surface materials have been partially removed, as within the drainage areas of Flat and Limestone creeks, the case is different; for the marls or limestones of the Tertiary formation are uncovered and brought in contact with the overlying loams, and thus are produced those fertile soils of the lime-hills and creek bottoms for which these localities are noted. The uplands bordering these creek lands are the usual sandy pine hills, and as these break off toward the creeks the lime-hills occur, which are usually very steep, and have comparatively little level land on top. The soils are of various colors, from gray and reddish to nearly black, usually pretty stiff, and sometimes contain shells. The bottom lands adjacent to the lime-hills are more sandy, but are usually more or less influenced by the lime of the hills, and make the best cotton lands in the county.

Below the latitude of Monroeville the county is a level or gently rolling piny woods, with occasional lime-sinks, which reveal the presence of the limestone beneath, but this rock seldom appears at the surface except along the banks of the streams. In all this region very little cotton is planted except in the lowlands adjacent to the Alabama river.

The cotton lands of Monroe county are the lowlands of Flat and Limestone creeks and the Alabama river. The uplands are generally sandy and not very productive, especially in the southern half of the county. There are some good bodies of table-land with brown-loam soil and red-clay subsoil, but these are similar to the brown-loam soils of the other counties. The marls from Flat creek, where they occur in large enough beds, might be used with advantage on the poorer upland soils, which are within convenient distance.

The agricultural characters of the Flat Creek region are shown in the following abstract.

ABSTRACT OF THE REPORT OF DR. J. M. HARRINGTON, OF NEWTOWN ACADEMY.

The lowlands of the region described are the first and second bottoms of Flat creek, a tributary of the Alabama river; the uplands are the rolling or level table-lands bordering upon the same. In the lowlands the cotton is generally later than on the surrounding uplands, on account of the cold nature of the soil in the former.

The soils described are: First, the stiff creek bottoms with adjoining sandy lands; second, the rolling lime-hills and their adjoining bottom lands; and third, the sandy uplands.

In the region under consideration about one-half of the cultivated lands are of the first kind, or creek lands. The prevailing timber is poplar, white oak, ash, beech, and sweet gum. The light soils are fine to coarse sandy, and the heavier, clayey loams sometimes quite stiff. The colors are varied, ranging from whitish to gray, brown, blackish, and black. A change of color to that of the subsoil is usually noticed at a depth of 6 inches. The subsoil is generally yellow or red, though sometimes it is of a bluish pipe-clay color, and when of the nature of a pipe-clay it is sometimes almost impervious to water. The underlying material is sand, gravel, or limestone, according to the locality. In tilling qualities the soil is difficult both in wet and in dry seasons, and is late, cold, and generally ill-drained. The crops produced upon it are corn, cotton, sweet potatoes, pease, oats, and rice. The soil is apparently best adapted to cotton, which makes about two-thirds of the cultivated crops. The lime lands occupy about one-fourth of the described area, and their natural growth is post oak, hickory, and maple. The soil is usually a heavy clay loam of a whitish, gray, buff, brown, or mahogany color, with an average thickness

to color change of 3 or 4 inches. The subsoil is generally heavier, and is underlaid with rock from 1 to 4 feet in depth. The soil is difficult of tillage in all seasons, but is early and warm, and is better suited to corn than to the other crops. Cotton makes only about one-fourth of the crop planted.

The sandy uplands form about one-fourth of the region herein embraced. The natural timber is long-leaf pine and black and red oaks. It is uniformly a fine sandy loam of whitish, gray, and other light colors, with a thickness of 2 to 4 inches down to the change of color. The subsoil is usually heavier, and contains sometimes rounded or water-worn pebbles of quartz, and is underlaid with sand or gravel. This soil is easily tilled under all circumstances, and is early, warm, and well-drained; is best adapted to corn, the cotton forming only one-fourth of the crops. The height of stalk varies from 2 to 3 feet on the pine lands to 5 or 6 on the lime-lands and in the bottoms, the most productive height being the medium.

The fresh pine lands will yield from 400 to 700 pounds of seed-cotton to the acre; the lime-hills and bottoms, from 1,000 to 1,200 pounds, and 1,545 to 1,660 pounds are needed for a 475-pound bale. The staple is low middling to good middling. By ten years' cultivation, without manure, the yield is brought down at least one-half, and the quality of the staple is slightly deteriorated. Crab-grass, cocklebur, hog-weed, and rag-weed are most troublesome. From one-third to one-fourth of the pine and bottom lands have been turned out, and at least two-thirds of the lime-hills; but the latter is hardly ever reclaimed, because it washes so badly that it is about ruined before it is turned out. The other lands, when reclaimed, produce better than when turned out, but not so well as when new. Very little effort has been made to prevent washes.

The cotton crop is shipped, as fast as baled, by boat to Mobile, the freight per bale being $1.

WILCOX.

Population: 31,828.—White, 6,711; colored, 25,117.

Area: 960 square miles.—Woodland, all. Oak and hickory uplands, with long-leaf pine, 600 square miles; central prairie region, 300 square miles (of which 200 square miles are of the hills prairie character and 100 of the rotten limestone); flatwoods, 60 square miles.

Tilled land: 161,228 acres.—Area planted in cotton, 77,076 acres; in corn, 40,053 acres; in oats, 7,011 acres; in sugar-cane, 251 acres; in rice, 14 acres; in tobacco, 15 acres; in sweet potatoes, 1,597 acres.

Cotton production: 26,745 bales; average cotton product per acre, 0.35 bale, 498 pounds seed-cotton, or 166 pounds cotton lint.

Wilcox county has for its underlying rocks the strata of the lowest or lignitic subdivision of the Tertiary formation, except along the northern edge on the eastern side of the river and the northwestern corner, west of the river, where the Cretaceous rocks are found. Where the calcareous beds mingle with the overlying strata of sand and loam a stiff, sticky soil of considerable fertility is produced, the growth on which is a mixture of short-leaf pines, post oaks, etc.

In the direction of Portland the uplands are covered with the strata of the drift, but as a descent is made toward Pine Barren creek the hard limestones and other calcareous Cretaceous rocks are encountered, and heavy, tenacious clays make the soil. Of the quality of these clays one can best judge after passing over them with a vehicle after rains, when the mud in certain stages of drying sticks to the wheels with a tenacity that is wonderful; it is difficult even to cut it off with a knife. A belt of country similar to this is passed between Dayton and Linden, in Marengo county, as there described.

The belt of flatwoods which, in Marengo county, has been mentioned as occurring immediately south of the sandy ridge of Linden, is seen in this county also in a similar position. The underlying rocks of the flatwoods are the laminated clays that lie at the base of the Tertiary formation. These flatwoods, in Wilcox, are known only on the western side of the river, southwest of Prairie Bluff.

In the lower part of the county the other Tertiary beds come to the surface. These consist of gray and dark colored clays and sands, with which is associated a marl bed containing the mineral greensand. As a consequence, whenever these calcareous beds are near enough to affect the soil a very marked improvement is observed. The lime-hills which characterize that part of the county west of the river and above Lower Peach Tree owe their existence to these beds. The surface in this region is very broken, and the lands suffer from washes; the soils are stiff, clayey, calcareous loams of gray, reddish, and darker colors, and the timber is mostly beech, with white oak, holly, hickory, ash, poplar, short-leaf and spruce pine. This lime-hill region is bounded on the south by a line of rocky hills, which are capped with sand and clay stones and timbered with long-leaf pine and black-jack oak; but these hills in most cases lie south of the county-line, in Clarke and Monroe. The characters of all these Tertiary strata and of the country formed of them have been described in some detail under Choctaw county, and need not be repeated here.

The river-hummock or second-bottom soils of Wilcox county are probably fairly well represented by an analysis of soil from 5 miles east of Lower Peach Tree (see page 44). The uplands of Wilcox are, therefore, mostly the sandy loams of the stratified drift and loam, and many of the lowlands, not bottom lands, are rendered highly fertile by the calcareous materials of the Lower Cretaceous and Upper Tertiary formations.

The drainage is altogether by means of numerous tributaries into the Alabama river, and the surface in general is broken, with a good deal of level bottom land in the large bends and in the flatwoods and prairies of the northwest.

A large proportion of the cotton crop of Wilcox county is produced in the numerous bends of the Alabama river. Perhaps the largest of these is Black's bend, in the southwestern part of the county, long celebrated for the great quantity of cotton annually produced there. The river has almost everywhere fine first- and second-bottom lands. The limy soils in the northeastern part of the county also bring fine cotton crops.

ABSTRACT OF THE REPORT OF HENRY C. BROWN, OF CAMDEN.

(The region described embraces the first and second bottoms of Pursley creek, a tributary of the Alabama river, and the hilly, partly limy, partly sandy uplands of the same drainage area.)

On the lowlands, when the spring season is wet, planting is late, and the cotton does not fully mature before it is seriously damaged by the caterpillar. The uplands, on the other hand, are earlier and more easily worked, but the yield is less than in the bottoms. When the caterpillar is late in coming the yield in the bottoms will double that in the uplands. The soils described are: 1, the stiff clayey and limy lands of Pursley creek; 2, the stiff clay lands with gravel, lying upon slopes, in patches of 15 to 20 acres; and 3, the sandy uplands with red-clay subsoil.

The bottom lands are about a fourth of the cultivated lands of the vicinity, and have a growth of white oak, hickory, elm, ash, beech, magnolia, sycamore, mulberry, and walnut. The soil varies from a light sandy to a heavy clay or often prairie-like loam, with gray to nearly black color. The average thickness to a change of color is 6 inches, and the subsoil is generally of a heavier nature. The soil will sometimes bake very hard after a rain and in hot sunshine, but by proper cultivation will yield a loose soft material. The subsoil often contains limy pebbles, and is underlaid with a marl or soft limestone at varying depths. In dry seasons the soil is easy of tillage, but in wet seasons it is very sticky. It is early and warm when well-drained, and produces well all the usual crops, being best adapted to cotton, sugar-cane, and rice.

The uplands, or hummocks, form about a third of the area in the region described, and their natural growth is pine, mulberry, black-jack, etc. The soil has the usual characters of the yellow loam, and rests upon beds of sand and gravel, with clay below in many cases. It is easy of tillage under all circumstances, and is early and warm and usually well-drained. The soil is apparently best adapted to oats, pease, potatoes, and corn, only about a fourth of the area being put in cotton.

The third variety of soil is that of the sandy lands, which have a growth of long-leaf pine, and which are the typical piny woods. The soil is of whitish to gray color, with sandy subsoil, sometimes containing pebbles. Only the poorer classes cultivate this land, which, with proper manuring, may be made to yield a support. It is best suited to sugar-cane, tobacco, rice, etc., and only about a third of the crop is cotton. The height of the cotton-stalk upon these soil varieties varies from 1 to 5 feet, according to quality and to the amount of manure used. Heavy manuring and wet weather sometimes cause the plant to run to weed, when topping and close cultivation are practiced to check the tendency.

The seed-cotton product on the fresh lands varies from 800 to 1,200 pounds, and about 1,545 pounds are needed to make a 475-pound bale. The staple rates as low middling. Five years' cultivation, without manure, will reduce the yield at least one-half, probably more, but without very materially affecting the quality of the staple. The troublesome weeds are hog- and blood-weeds, cocklebur, and puralane. Very little of the best land is abandoned, but probably a third of the poorer qualities are not now under cultivation. They all improve by resting; but the piny woods are hardly thought to be worth the trouble of reclaiming after having once been turned out. There is a good deal of injury from washes, and very little effort has been made to check it. The valleys are sometimes ruined by the sands washed down upon them.

ABSTRACT OF THE REPORT OF FELIX TAIT, OF CAMDEN.

The lands reported lie along the Alabama river. The lowlands are the first and second bottoms of the Alabama river and the cypress swamps, which, when well drained, make the richest farming lands. The uplands are one-fifth limy, the rest sandy, and the pine woods have a very light soil. There are, so far as known, no local causes which influence the growth of the cotton-plant. The only soil described is the sandy soil, which constitutes four-fifths of the land. Upon this land the timber consists of the various species of pine and oak, with hickory, ash, elm, poplar, cedar, etc., according to the position and quality of the soil. In its physical properties it embraces many variations, from heavy to light sandy loams. The subsoil on the red lands and prairies is heavier than the soil, but on the gray or yellow pine lands it is lighter, and white rounded pebbles of quartz are by no means uncommon throughout. The soil is usually of easy tillage, except where there is much lime or clay present. Corn, cotton, oaks, potatoes, and pease are the chief crops, but the soil seems best adapted to corn and cotton.

About a third of the area is in cotton, which grows to a height of 2 to 4 feet, the largest stalks being the most productive. When there is too much rain, or when the land is put in cotton the first year after clearing, there is a tendency of the plant to run to weed, which is checked by topping and by cutting off the suckers. From 600 to 1,200 pounds is the average yield of seed-cotton of the fresh land (1,545 pounds to a 475-pound bale). The staple rates as low middling. Long cultivation reduces materially the yield, but does not change much, if at all, the quality of the staple. Hog-weeds and coffee-weeds are the most troublesome to the farmer. About an eighth of the land lies turned out. Some qualities are improved by resting; others apparently very little, if at all. The soil washes badly, and much injury is often experienced from this cause; but the valleys are not as a general thing much hurt, and only insignificant efforts have been made to stop the washings.

Shipments of cotton are made from September to January, by steamboat, to Selma or Mobile, the rates of freight varying from $1 to $1 50 per bale.

BUTLER.

Population: 19,649.—White, 10,684; colored, 8,965.

Area: 800 square miles.—Woodland, all. Oak and hickory or brown-loam uplands, 330 square miles; pine uplands, 400 square miles; hill-prairie region, 30 square miles; lime-hills, 20 square miles.

Tilled land: 87,010 acres.—Area planted in cotton, 35,851 acres; in corn, 24,648 acres; in oats, 7,494 acres; in sugar-cane, 338 acres; in rice, 17 acres; in sweet potatoes, 679 acres.

Cotton production: 11,895 bales; average cotton product per acre, 0.33 bale, 471 pounds seed-cotton, or 157 pounds cotton lint.

The underlying rocks of Butler county, except a narrow strip in the northern part of the county, which is underlaid with the Cretaceous rocks, belong to the Tertiary formation. As is the case in all the southern part of the state, this substratum of the older rocks is covered more or less completely with beds of drift, consisting of sand, occasional pebbles, and, uppermost of all, a red or brown loam, which is concerned in the formation of far the greater part at least of the upland soils. It is only at the lower levels that these underlying rocks are sufficiently near the surface to exercise any influence upon the soils, with the exception of the aluminous sandstones of the buhr-stone group, which crop out in some of the highest and most rugged hills in the lower part of the county. These sandstones give rise to very poor sandy soils, on which prevails a growth of long-leaf pine; but underneath the sandstones are gray clays with thin beds of a calcareous nature, often containing the mineral greensand; so that even in this hilly and generally poor country the slopes and creek bottoms are quite productive from the washings from these limy beds.

Below Greenville the county is generally of the pine-hills character, especially the uplands. Around Greenville there is a considerable area of red lands (often containing pebbles and fragments of brown iron ore in quantity), timbered with Spanish and post oaks, hickory, and short-leaf pine, sweet and sour gum, and some chestnut and chincapin. The top soil is a brown loam, passing into the deep-red loam at a few inches depth. In favorable seasons this land will yield, when fresh, 1,000 pounds of seed-cotton or from 25 to 30 bushels of corn to the acre.

In the northern part of the county the beds of the Cretaceous formation are encountered, and they give rise to several very characteristic soil varieties. The rocks of this formation in Butler county are hard limestones of a yellowish color, interbedded with softer materials, which are easily removed by the action of the weather. The limestones thus undermined break off in ledges, which crop out along the slopes of numerous very steep limy hills. The soils of these hills are stiff calcareous clays, which, by intermixture with the overlying loams, produce a number of soil varieties. Within this area are small detached bodies of somewhat level land, timbered with post oaks chiefly, to which the name of post-oak-beeswax prairies has been applied. Other lands of a flatwoods character exist which are timbered chiefly with pines, and these are called beeswax-pine lands but none of them are of the same character or origin as the post-oak flatwoods of Sumter and Marengo counties, which are based upon a Lower Tertiary clay. In the northwestern corner of the county there is a small area of prairie land noted for its productiveness and fine cedar timber. This is of the same kind as the calcareous lands of that part of Wilcox county which immediately adjoins it.

In its agricultural features Butler is similar to the adjoining counties. In the lower part of the county the pine lands are generally cultivated with the use of commercial fertilizers, and the red-loam subsoil of most of these lands is well calculated to retain the manures.

The Mobile and Montgomery railroad traverses this county, and affords a means of transportation to market for the products of the county. Planters usually sell their cotton crop to the merchants at the nearest railroad station, and, for some parts of the county, it is sent to Troy, in Pike county.

CONECUH.

Population: 12,605.—White, 6,224; colored, 6,381.

Area: 840 square miles.—Woodland, all. Lime-hills and red lime-lands, 470 square miles; pine uplands, 120 square miles; rolling pine lands, 250 square miles.

Tilled land: 46,965 acres.—Area planted in cotton, 16,523 acres; in corn, 20,118 acres; in oats, 3,173 acres; in rye, 32 acres; in sugar-cane, 267 acres; in rice, 121 acres; in sweet potatoes, 652 acres.

Cotton production: 4,633 bales; average cotton product per acre, 0.28 bale, 399 pounds seed-cotton, or 133 pounds cotton lint.

The rocky substratum of Conecuh county is made by beds of the Tertiary formation, and over all is spread a mantle of irregularly stratified sands, clays, pebbles, and loams, constituting the southern or stratified drift. The beds of the buhr-stone group underlie the northern part of the county, and the white limestone of the Vicksburg age makes its appearance in the southern part, whence to the Florida line it is the country rock. The buhr-stone rocks consist for the most part of a series of hard aluminous and siliceous sandstones, which yield with difficulty to the leveling action of water, and hence within the region of their occurrence high rugged hills are the characteristic features, and in so far as the soils are derived from these rocks they are in general poor. These hilly areas are usually covered with a growth of long-leaf pines, with some oaks. Below the buhr-stone is a black laminated clay, interstratified with beds of a greensand marl, and the lands which lie under the hills containing this mineral are always of most excellent quality.

South of this rugged country the land is comparatively level to within 3 miles of Evergreen, where a calcareous sandstone, holding beds of fossiliferous greensand containing a large percentage of lime, outcrops from the hillsides. South of this the county is underlaid with the white limestone, which, as a rule, is so covered with the sands and other beds of the drift as to be of very little importance in the formation of the soils, except where, by a partial removal of these beds by denudation, it is brought near enough the surface to influence the loam soils overlying it. This is the case along the drainage slopes of a belt of land extending from the vicinity of Bellville southeastward toward Brooklyn. These lands lie contiguous to Murder, Beaver, and Bottle creeks, and form an interrupted strip of about 6 miles in width. Throughout this section are knolls of rather hard lime-rock of a yellow color, which make an excellent lime when burned, and which are generally quite fossiliferous. The lands below such outcrops of lime-rock are the best in the county, and have a red-loam, soil with a stiff-clay subsoil, and a natural growth consisting of sweet gum, water oak, white oak, magnolia, cedar, short-leaf pine, and spruce pine. In this area are also outcroppings of the soft white limestone which is so universally used as material for building chimneys, since when freshly quarried it can be easily cut with an ax or a saw. Lime-sinks are a characteristic feature not only of this area, but also of all the country underlaid with the limestone. The rocky knolls spoken of are not much in cultivation because of the rock fragments, but the soil is very rich and of a black color, and as the hills break off toward the lowlands there are many tracts of black limy soil. These red and black lime-lands are considered the best farming lands in Conecuh. The highlands lying between the patches of lime land are sandy, and of the usual pine-hills character.

Southward of the lime-lands the county is gently undulating piny woods, with lime-sinks, and occasionally lakes or ponds which reveal the existence of the limestone beneath the sands. This rock makes its appearance along the banks of some of the streams. As a general rule, the surface materials which overlie the white limestone are sandy, with very little clay. From the porous nature of these beds the water which falls upon them is rapidly absorbed and drained away by the underground channels with which the limestone is traversed, and thus causes very little erosion. The resulting face of the country is hence nearly level, sloping off very gently toward the water-courses. This is the nature of the rolling pine lands of the lower part of Conecuh, and, indeed, of the country southward into Florida.

From the above general account, it will be seen that, while Conecuh county has a large proportion of sandy loam soils with a growth of long-leaf pine, there are two or three belts across the county in which the calcareous matter of the underlying rocks brings about very desirable modifications of the prevailing soils, especially in the lower-lying areas. Where this marling of the soils has been effected by natural causes its good effects are apparent, and there is no reason why the greensand marls, which are to be found in several parts of the county, should not be used with profit by the farmers on their poorer lands.

The choice farming lands of this county, as may be inferred, are the red lime-lands of Murder, Beaver, and Bottle creeks, most of which have long been in cultivation, and before the war were held at high prices—$15 to $20

an acre. Since the war many of them appear to have been somewhat neglected, though they are still fine lands. The cultivation of cotton on the other lands in the county needs no special notice. The use of commercial fertilizers is becoming general upon such lands, not only in this but in the other counties of the state.

ABSTRACT OF THE REPORT OF REV. ANDREW JAY, OF JAYVILLA

(This report refers to the region drained by Murder creek and the Escambia river.)

The soil varieties are: 1, the red upland soil lying on Beaver and Murder creeks, but above overflow; 2, the hummock or sandy bottoms reaching from the creeks to the table-lands, sometimes overflowed; and 3, pine lands, sandy, with clay foundation, and hilly.

Of these soils the most important to the farmer are the red uplands, though constituting only one-fourth of the area. These lands are to be found in detached bodies, interspersed with the pine lands. The usual growth is white oak, beech, ash, hickory, elm, and red oak. Most of the land of this kind has been cleared up. The soil is a light loam of reddish to blackish-red colors, 3 to 6 inches deep to a change of color, but which mixes so gradually with the subsoil that the exact depth is difficult to determine. The subsoil is of a heavier nature than the soil, is tough, but when exposed to the air it becomes pulverized and mixes readily with the surface soil, to which it seems to impart some fertility. It often contains pebbles, and rests upon rock at varying depths. This soil is easy of tillage, early, warm, and well drained, and yields good crops of cotton, corn, oats, potatoes, and pease. Since the land has become worn it seems to be best adapted to corn, oats, and pease, as the cotton rusts. As it is, however, cotton makes about half the cultivated crop. Upon freshly-cleared land the stalk attains a height of 5 to 7 feet; upon the worn land, 3 to 5 feet.

The sandy bottom lands are not described in detail. The pine hills occupy half or more of the area, and are interspersed with the creek lands, their usual growth being chiefly long-leaf pine, with dogwood and red and black-jack oaks. The soil is a light-colored fine sandy loam, 1 to 2 inches deep to a change of color; the subsoil is heavier, being a clayey loam, which is stiffer the deeper it is taken. The soil is easily tilled at all times, and is rather late and cold, but well drained. Most crops do well upon it, but cotton occupies the greater portion. The height attained depends upon the quality and quantity of the fertilizers used. When there is too much rain, there is a tendency of the plant to run to weed, which may be checked by topping or by running a furrow close to the roots.

The seed-cotton product of the fresh land is 1,200 pounds for the red lands, and from 300 to 400 pounds for the other. The staple is middling to good middling, and 1,545 pounds are needed for a 475-pound bale. The red land, after 50 years' cultivation, will bring 300 to 500 pounds, but after 5 years' cultivation of the pine land it is practically exhausted unless manure is used. With manure the yield may be brought up to a bale to the acre. The staple from the worn land is a little shorter than that from the new, but there seems to be very little difference in the proportion of seed to lint. Crab-grass is the most troublesome weed, and on the red lands cocklebur, hog-weed, and coffee-weed also give trouble. About half of the red lands lie turned out, but after a long rest of 20 or 30 years they will produce nearly as well as when new. The slopes are long and gentle, and the injury from washes comparatively slight, the valleys being often rather benefited by the settlings. The pine lands have been more generally kept up than the preceding, and only a small proportion of them has been turned out. The injury from washes is much greater with these than with the other lands. Horizontalizing and hillside ditching have been tried to a small extent, with good results where properly done.

ABSTRACT OF THE REPORT OF P. D. BOWLES, OF EVERGREEN.

The lowlands are the first and second bottoms of Beaver creek, and also the alluvial plains of Murder creek and white-oak flats with water oaks and magnolias. The uplands are the rolling and level lands with gray, limy soil, partly sandy, bordering on the bottom lands of Murder creek and Conecuh river. The greater part of this section has a red-clay subsoil. Early planting in the lowlands is frequently injured by late frosts, and cold days give the cotton "sore-shin" and otherwise retard its growth. Want of rain in June, July, and August causes more damage than anything else, except the cotton-worm. On the other hand, too much rain will produce the same effect by causing the forms and young fruit to drop off. Early frost is never feared in this locality. The soils described are: 1, gray sandy uplands, with red-clay subsoil very near the surface; 2, level lime prairie, with lime-sinks and shell mounds; 3, thin pine lands, with gray sandy loam soil.

The gray uplands in the neighborhood of Evergreen constitute perhaps three-fourths of the arable lands. When well worn the soil becomes red-colored, and the growth on such soils is of white, Spanish, and water oaks, sweet-bay, magnolia, poplar, and beech. The light soils are fine sandy loams of gray and red colors; the heavy soils, clay loams, of depths of color varying according to the length of time they have been under cultivation. The average thickness of the soil to a change of color is about 10 inches. The subsoil, as a general thing heavier than the soil, is of a deep-red color, except in the more limy spots, where the color is yellow, and frequently contains fragments of soft lime-rock, underlaid with the same at a depth of from 3 to 20 feet. About half this land is in cotton, which grows to a height of 5 or 6 feet.

The level lime prairies are found in a belt 6 miles wide extending across the county, principally in township 5. Oaks, walnut, hickory, and birch are the principal trees. The light soils are gray, limy loams; the heavier are clay loams, of gray, brown, and blackish to black colors. The subsoil is heavier than the surface soil, being a very soft yellow limestone, continuing some 3 feet to the hard limestone rock. It contains fragments of the soft lime-rock above mentioned. Tillage is rather difficult, both when too wet and when too dry; and when ill-drained the soil is late and cold. It seems to be best suited to corn, though cotton is planted upon about half of the uplands, but on very little of the lowlands. The plant grows to a height of from 4 to 7 feet, being most productive at 5 feet.

At least one-half of the county is composed of the sandy pine lands, especially the southern, northwestern, and southeastern portions. Long-leaf pine is the characteristic tree, but with it, in places, are also oaks of several species and some hickory. The soil is a fine sandy loam, with clay in places, with whitish, gray, to blackish colors, according to length of time under cultivation. The thickness is 6 to 8 inches to a change of color; subsoil rather heavier, being almost without exception yellow or red clay, containing rounded pebbles of quartz, especially along the branches. The underlying substance is either sand and gravel, or sometimes hard limestone rock at 10 to 20 feet. Tillage is easy at all times, and the soils are early and warm when well drained, which is commonly the case. This land is best suited to sugar-cane and sweet potatoes, and only about one-fourth of the area is put in cotton, which grows from 2 to 4 feet in height, being most productive at 3 feet. On new land, and when shaded or planted too close, the plant sometimes runs to weed, for which topping in July, application of fertilizers, and giving more room are the usual remedies. From 1,000 to 1,800 pounds of seed-cotton may be obtained from fresh land, and 1,660 pounds are needed for a standard 475-pound bale. The staple rates as middling. Ten years' cultivation, without manure, will bring down the yield on these lands at least one-half, and the staple will be slightly inferior, rating as low middling or good ordinary. The cocklebur on limy land, the butter-weed on new land, and the Florida clover on all, are troublesome to the farmer. From 10 to 25 per cent. of the formerly cultivated lands are turned out (less of the lime-lands than of the others), and when reclaimed these lands will often yield nearly as well as when new. Where the land is hilly the uplands are often ruined by the washing away of the soil, but the valleys are seldom injured, but, on the contrary, often improved, by receiving the washings from the higher lands. Very little systematic effort has ever been made to check this evil, except in the very best of the lands.

The cotton is shipped as fast as baled, by railroad, to Mobile, at the rate of $2 per bale.

COVINGTON.

(See "Long-leaf pine region".)

CRENSHAW.

Population: 11,726.—White, 9,118; colored, 2,608.

Area: 660 square miles.—Woodland, all. Long-leaf pine uplands, 435 square miles; oak and hickory or brown-loam uplands, 125 square miles; hill prairies, containing about 10 square miles of red lands, 60 square miles; red lime-lands, in lower part of county, 30 square miles.

Tilled land: 67,770 acres.—Area planted in cotton, 26,962 acres; in corn, 28,099 acres; in oats, 5,208 acres; in tobacco, 33 acres; in rice, 25 acres; in sugar-cane, 294 acres; in sweet potatoes, 558 acres.

Cotton production: 8,173 bales; average cotton product per acre, 0.30 bale, 429 pounds seed-cotton, or 143 pounds cotton lint.

Crenshaw county, lying between Butler and Pike, has many points of resemblance to each. It has already been remarked that as we go east the sands and loams of the post-Tertiary appear to increase in thickness to the extent often of covering almost entirely the underlying rocks. For this reason the eastern counties depend for their soils and physical features generally to a very great degree upon these surface beds.

Crenshaw county has for its underlying strata the Lower Tertiary beds, and, in the northern tier of townships, the uppermost beds of the Cretaceous formation. These Cretaceous rocks consist of alternations of hard crystalline limestones and softer strata of calcareous clays. As a rule, these beds are covered with the drift deposits, and exercise little influence upon the soils. A red soil, with small rounded lumps of brown iron ore, occurs in the northern part of the county, overlying a limestone ridge of the Cretaceous formation. The influence of the underlying lime-rocks is frequently felt in the soil, giving rise to highly productive calcareous soils, and the washings of these lands improve very greatly the bottom lands of the streams contiguous to them. In the latitude of Rutledge a white limestone of considerable purity is to be found in the banks of the streams, and occasionally at higher levels. This has been burned, and makes an excellent lime for building purposes, and could be profitably employed on the lands.

The lower half of the county is, in general, piny woods, with areas of very good oak and hickory lands alternating with the prevailing pine lands. In a few localities in the extreme south of Crenshaw county occurs a kind of red lime-land, which results from the reaction of the white limestone upon the overlying red loam. These lands occur usually where the greater part of the overlying beds has been washed away and the limestone is thus brought near the surface, and lie in the vicinities of Leon and of Bullock, along tributaries of the Patsaliga, Conecuh, and Yellow rivers. They are of comparatively limited extent, and resemble both in quality and origin the lime-lands of Murder creek and other localities in Conecuh county.

A large proportion of the lands of Crenshaw are pine lands, and as a rule are deficient in lime. The occurrence of limestone over a considerable area through the center of the county might be turned to good account in improving these lands. Commercial fertilizers are now pretty generally used throughout the county in the culture of cotton, and where the subsoil is a red clay, as is the case over a large part of the county, these fertilizers do well.

ABSTRACT OF THE REPORT OF GEORGE W. THAGARD, OF RUTLEDGE.

The lowlands described are the first and second bottoms of Patsaliga river, together with cypress swamps and gallberry flats, and the uplands are the rolling and level lands contiguous to the same stream. In general, the uplands are preferred for cotton, for the reason that the lowlands are late, and the cotton, therefore, much more likely to be injured by frost.

The three most important soils described are: First, the high mulatto lands and gray oak and pine lands; second, the dark loam of Patsaliga river bottom above overflow; and third, the sandy bottom lands of the same stream. Of these soils the most widely distributed are the gray sandy uplands, making at least three-fourths of the county. The natural growth is long-leaf pine, oaks, hickory, gum, and cypress. In its physical characters the soil presents the usual varieties of texture and color so often described for similar soils. The average thickness to a change of color to that of the subsoil is from 2 to 6 inches. The subsoil is either red clay or yellowish sand, or some intermediate grade between the two, and when undisturbed becomes quite impervious. It frequently contains rounded white pebbles of quartz, and is underlaid at greater or less depths by lime-rock in this vicinity. The soil is always easily tilled, and is cultivated in cotton, corn, oats, and sweet potatoes, but is best suited to cotton, which makes about one-half of the cultivated crop. The most productive height of stalk is 3 or 4 feet, but the height varies from 2 to 6 feet. A tendency to run to weed is sometimes seen in cotton growing upon fresh land, especially in wet seasons, and the best remedy is a stimulation of the growth by the liberal application of barnyard or commercial manures.

The average seed-cotton product of the fresh land is 900 pounds (1,425 pounds to a 475-pound bale); staple excellent (grade No. 1 given). Five years' cultivation will bring down the yield to 500 pounds, with little or no difference in staple and in proportion of lint. The Florida clover or "poor man's trouble" is the greatest pest in the way of a weed. Perhaps a sixth of the originally cultivated land now lies turned out, but such land, when again taken into cultivation, produces very well if fertilized. In some localities there is much injury from washings, but no serious efforts have been made to check it.

There is no railroad or navigable stream in Crenshaw, and the cotton crop is usually hauled in wagons to Troy, Greenville, or Montgomery, at an average cost of $2 per bale.

MONTGOMERY.

(See "Central prairie region".)

BULLOCK.

(See "Central prairie region".)

BARBOUR.

(See "Central prairie region".)

PIKE.

Population: 20,640.—White, 14,368; colored, 6,272.

Area: 740 square miles.—Woodland, all. Oak and hickory uplands, with long-leaf pine, 590 square miles; pine hills, 150 square miles.

Tilled land: 114,850 acres.—Area planted in cotton, 47,107 acres; in corn, 42,207 acres; in oats, 5,424 acres; in wheat, 72 acres; in rye, 23 acres; in sugar-cane, 400 acres; in sweet potatoes, 883 acres.

Cotton production: 15,136 bales; average cotton product per acre, 0.32 bale, 466 pounds seed-cotton, or 152 pounds cotton lint.

Sandy ridge, with a substratum of marl and sometimes limestone of the Upper Cretaceous age, passes through the northern townships of Pike county. Further east it is known generally as Chunnenugga ridge, and it is a notable feature of the landscape, as well as characteristic from an agricultural standpoint. Upon the level portions of this ridge the soil is sandy and comparatively poor, but where the drainage has removed these surface beds the calcareous strata are brought to the surface and produce lasting and productive soils. The bottom lands, which receive the washings from these calcareous beds, are of the best character. Southward of this ridge there is a strip of calcareous clayey land, varying in width from 3 to 5 miles, and running east and west through the county. The southern limit of the Cretaceous formation is seen a few miles north of the town of Troy, where its strata are exposed in the banks of the Conecuh river. This limit of the two formations is, however, concealed, except along the banks of streams, by thick beds of sand and loam, which form the soils generally thence southward.

East of Troy, according to Thornton, in the Pocoson settlement, the valleys, which have the luxuriant growth and appearance of swamps, are surrounded on three sides by ridges of snow-white sand, on which grows only a scrubby oak, covered with long moss. In the latitude of Troy, and a few miles below, calcareous beds of the Lower Tertiary formation outcrop in places, producing a stiff limy and clayey soil of considerable fertility, but 7 or 8 miles south of Troy the siliceous and argillaceous sandstones of the buhr-stone group come to the surface, and, as usual where this is the case, the soils are poor and the prevailing growth long-leaf pine.

The county below Troy is generally piny woods, with alternations and admixtures of oak and hickory lands. As is so often the case, the pine lands are upon the level dividing plains between the water-courses, while the oaks and other trees occupy more generally the slopes and lower levels. In the vicinity of Brundidge there is a rather stiff clayey soil of much fertility, and this is considered one of the best farming areas of the county.

In Pike county the upland soils are, as a rule, poor in lime; the lowlands in places are better in this respect. A bed of tolerably pure limestone, which outcrops occasionally in the central and western parts of the county, might be profitably used to remedy this deficiency. There are also some beds of a greensand marl within the county limits. The clayey nature of most of the upland subsoils allows commercial fertilizers to be profitably used.

The great cotton mart for this and also for the adjoining counties is Troy, and the crop is hauled to this place from great distances, most of the wagons which carry cotton to the market returning with bags of guano and other commercial fertilizers.

COFFEE.

Population: 8,119.—White, 6,831; colored, 1,288.

Area: 700 square miles.—Woodland, all. Pine uplands, 340 square miles; rolling or undulating pine lands, 360 square miles.

Tilled land: 42,126 acres.—Area planted in cotton, 16,431 acres; in corn, 18,668 acres; in oats, 2,370 acres; in rye, 31 acres; in wheat, 22 acres; in rice, 21 acres; in sugar-cane, 254 acres; in sweet potatoes, 474 acres.

Cotton production: 4,788 bales; average cotton product per acre, 0.29 bale, 414 pounds seed-cotton, or 138 pounds cotton lint.

The northern part of Coffee county, where the Claiborne beds are the underlying rocks, is in general much more broken and hilly than the southern, which is underlaid with the Vicksburg or white limestone. Above Elba there is a good deal of what are usually called "red-clay hills", alternating with sandy bottoms. The growth upon such land consists of long-leaf pine, with the species of upland oaks, sour gum, etc., and the soil is fairly productive. As representing the average composition of this class of upland soils we may take the analysis of an oak upland soil from near Lawrenceville, Henry county (No. 84, page 43).

Below Elba, along the water-sheds at least, the country is nearly level or gently undulating, with here and there a basin-shaped depression (sometimes filled with water, forming a pond or lake, sometimes dry)—evidences of the existence of the limestone below. This rock, however, rarely comes to the surface, except along the water-courses, but is covered with thick beds of the stratified drift materials. These materials upon the higher level areas are prevalently sandy; while along the drainage slopes the more clayey materials are to be found, and it is only in these latter places that the soil is cultivated. The sandy level areas away from the water-courses are covered with long-leaf pine forests, which are used as pastures for cattle and sheep. Some very good farming tracts are to be met with in the vicinity of the creeks and branches. It is perhaps needless to say that human habitations are rarely met with upon these pine barren plateaus.

Coffee is a fair representative of the lower counties of the state. It is well drained by Pea river, Double Branches creek, and their numerous tributaries.

ABSTRACT OF THE REPORT OF M. G. STOUDENMEIER, OF ELBA.

The soil varies from fine to coarse sandy or gravelly loam, with a growth of long-leaf pine, intermixed with various species of oak and hickory, and undergrowth The color varies from light-gray to reddish and other dark colors; thickness, about 4 inches before its color is merged into that of the subsoil. The latter contains usually more or less of yellowish clay, which bakes hard upon exposure, and is often very impervious. It frequently holds white quartz pebbles. It is easily tilled under all circumstances, and is warm and well drained.

The chief crops cultivated are cotton and corn, the former occupying about 50 per cent. of the cultivated area. The stalk attains usually a height of 3½ feet, but is more productive when at least 4 feet in height. With deep plowing, and in wet seasons, the plant

sometimes inclines to run to weed, which tendency may be checked by shallow or surface tillage. The fresh land will produce 600 pounds of seed-cotton to the acre, 1,425 pounds of which go to make a 475-pound bale. The staple rates in the market as low middling. After five years' cultivation (unmanured) the yield is 400 pounds, having about the same proportion of lint to seed-cotton, the staple of which usually rates one grade lower. The most troublesome weed (exclusive of grasses) is the Florida clover. About one-half of the land originally cultivated now lies turned out, but some of it is being reclaimed, and for two or three years it produces nearly as well as when fresh. From the nature of the soil there is considerable injury from washings, the valleys being often damaged to the extent of 10 per cent. by the washings from the uplands. As yet no efforts have been made to check the evil.

The cotton is hauled in wagons to Troy, in Pike county, at an average cost of $2 50 per bale, and there sold. The shipping begins usually in October.

DALE.

Population: 12,677.—White, 10,553; colored, 2,124.

Area: 650 square miles.—Woodland, all. Pine uplands, 420 square miles; undulating pine lands, 230 square miles.

Tilled land: 68,413 acres.—Area planted in cotton, 27,076 acres; in corn, 31,867 acres; in oats, 5,114 acres; in wheat, 59 acres; in rye, 24 acres; in rice, 49 acres; in sugar-cane, 373 acres; in sweet potatoes, 872 acres.

Cotton production: 6,224 bales; average cotton product per acre, 0.23 bale, 327 pounds seed-cotton, or 109 pounds cotton lint.

Dale county in its geological structure and in its surface features bears a close resemblance to Coffee county, on the west. The strata of the Claiborne and Vicksburg groups of the Tertiary are the underlying rocks, and these are covered by heavy beds of sands, loam, and pebbles to the extent of concealing almost entirely the underlying country rocks. These two groups of the Tertiary formation underlie each about half of the county, the Claiborne in the north and the Vicksburg in the south. Neither is largely concerned in the formation of arable soils, since they are derived almost exclusively from superficial beds. Upon the topography, however, these lower rocks exert a decided and easily-recognized influence. To appreciate this one has only to consider the difference between the broken and hilly aspect of northern Dale with the level, or at most gently rolling, pine forests of the southern part. For several miles around the county-seat (Ozark) deep beds of sand are a notable feature.

In the northern part of the county, where the drainage has cut through the overlying deposits, the country rock, which is generally an aluminous sandstone, full of shells or casts of shells, is exposed. Some varieties of this rock are, when freshly quarried, easily cut with a saw or other implement, and blocks of it are extensively used in the construction of chimneys and pillars to the houses. In this northern part there is usually a red loam substratum to the soils, while in the southern part the loam, though not entirely absent, is comparatively unimportant. At Newton it is present in great thickness. Below Newton the irregularities of surface are very slight, 10 or 15 feet being often the difference in elevation between the water-courses and the dividing land. The surface soil is mostly sandy, and the country rock is seldom seen until near the Geneva county-line, where there are several large limestone springs and outcrops of a white fossiliferous limestone. This rock appears to have generally very little influence upon the overlying soil; but there are spots where the soil is a calcareous clayey loam, formed by the reaction of lime-rock upon the overlying loam. The rich lime-lands of Murder creek, in Conecuh county, are of a similar nature.

ABSTRACT OF THE REPORT OF J. C. MATTHEWS, OF CRITTENDEN'S MILLS.

The soils enumerated are red clayey loam, gray bottom soil, and the sandy soils. The most important in an agricultural sense are red loams, which make perhaps a tenth of the cultivated area. This soil, which is so prevalent in the counties further north, is seen in this county only in spots. Its natural growth is oak, hickory, and gum, with short- and long-leaf pines added, in accordance with the variations in the quality of the soil. It is a clayey loam of buff to brown colors of an average thickness of 6 inches before the color changes to that of the subsoil, which is heavier than the surface soil, being a joint clay and white marl, and often contains rounded pebbles of white quartz, and is itself underlaid by a black rock at 15 feet depth. It is considered difficult of tillage, since it gets dry and hard. It is, however, early, and produces well the usual crops, to all of which it seems to be well adapted.

The bottom lands of the Choctawhatchee river are next in importance. Their natural timber is a mixture of oaks, hickory, poplar, gum, etc. The lighter soils are sandy loams; the heavier are clayey loams. The colors are whitish, gray, buff, brown, mahogany, blackish to black, and the average thickness to a change of color is 2 or 3 inches. The subsoil is a joint clay, underlaid with a black rock at 10 feet depth. This soil is early, but rather difficult of tillage, and is considered best suited to the cotton crop. Between these two extremes of soil there are all intermediate grades.

About two-thirds of the red or brown-loam lands and a fourth of the Choctawhatchee bottoms are in cotton, which is most productive at a height of 3 feet. Too much rain in July sometimes causes the plant to go to weed, for which no remedy is usually tried. The seed-cotton product per acre (fresh land) is from 600 to 1,000 pounds, and the staple rates as middling or strict middling. Cultivation five or six years without manure will reduce the yield a third or more without making any observerable difference either in the quality of the staple or in the proportion of the lint to seed. Crab-grass, hog-weed, and Florida clover are the most troublesome weeds. About one-fourth or one-fifth of these lands once in cultivation now lie turned out, and when taken again into cultivation do not produce very well. The land suffers to some extent from washings, but no well-directed efforts have been made to check the evil.

The cotton crop is usually hauled in wagons, as fast as baled, to Eufaula, Troy, or Columbus, Georgia, at the rate of 38 to 40 cents per hundred pounds.

HENRY.

Population: 18,761.—White, 11,994; colored, 6,767.

Area: 1,000 square miles.—Woodland, all. Oak, hickory, or brown-loam uplands, 100 square miles; pine uplands, 550 square miles; undulating pine lands, 340 square miles; red lime-lands, 10 square miles.

Tilled land: 137,348 square miles.—Area planted in cotton, 54,305 acres; in corn, 48,661 acres; in oats, 7,902 acres; in rye, 263 acres; in wheat, 193 acres; in tobacco, 24 acres; in rice, 25 acres; in sugar-cane, 671 acres; in sweet potatoes, 1,266 acres.

Cotton production: 12,573 bales; average cotton product per acre, 0.23 bale, 327 pounds seed-cotton, or 109 pounds cotton lint.

The upper half of Henry county is underlaid with the strata of the Claiborne group, and the lower by those of the Vicksburg, and a coating of drifted materials of considerable thickness covers these throughout the county. These superficial beds present notable differences in different sections. In the northern part of the county they are characterized by the generally red or orange color of the subsoil, which contains a large proportion of clay, and which lies upon reddish or yellow sands, frequently containing gravel. The soils in this section vary in the proportions of sand and loam in different localities. Upon the water-sheds the sandy soils are, as a rule, predominant, while upon the slopes the more loamy soils prevail. General reasons for this distribution have been mentioned before.

The topography in the upper part of the county is, like the soil, much more varied than in the lower. In the lower half the sandy soils prevail, and comparatively level pine woods constitute the landscape very generally. The drainage is principally into the Chattahoochee river, but a small area in the northwestern part is drained by the Choctawhatchee. The better class of upland yellow-loam soils, which are prevalent in the upper part of the county, are in chemical composition represented by the analysis of the soil from near Lawrenceville, given on page 43.

In the southwestern corner of the county, in the drainage basin of Big creek, there are a few miles of red lands of calcareous nature, similar to the red lands of Jackson county, Florida, and of the adjacent part of Geneva county. This land, which has its counterpart in the lime-lands of Murder creek, in Conecuh county, is produced by the action of the limestone upon the loam soil overlying it. The agricultural peculiarities of the first-mentioned soils are given in the following abstract.

Henry county shows agriculturally no peculiarity. Cotton is cultivated on upland and bottom soils of the usual character afforded by the drift and loam which overspread so great a proportion of the southern part of the state. The river lands here, as elsewhere along the Chattahoochee, have a large proportion of fragments of mica or isinglass mingled with the other ingredients of the soil.

ABSTRACT OF THE REPORT OF A. M'ALLISTER, OF SHORTERVILLE.

The most important soils in the vicinity of Shorterville are the river bottom soils, and of these the "isinglass" soils are considered best, because most certain. The usual bottom growth of hickory, oak, ash, walnut, sweet gum, bay, etc., is found. Both soil and subsoil are sandy loams of various colors; whitish and gray most abundant. Tilling qualities easy under all circumstances. The soil is early, warm, and well drained as a rule, and is well suited to the production of cotton, corn, oats, rye, potatoes, sugar-cane, field pease, etc. The upland soils of the northern part of the county are fine to coarse sandy loams, heavy, clayey loams in places, resting upon a sandy, sometimes gravelly, clay; thickness of the soil to a change of color, variable—12 to 15 inches. They are all easily tilled, and are warm, early, and well drained. These usual crops are all cultivated with success.

The pine lands in the upper part of the county are not characteristic, but in the middle and southern sections pine forms almost the exclusive growth, except along the streams. The surface soil is generally a dark-gray or brown sandy loam, the subsoil a sandy clay, with occasionally pebbles. The soil is early, well drained, easy of tillage, and suited to the usual crops: cotton, corn, sugar-cane, etc.

About half the cultivated land of each of these soil varieties is planted in cotton, which grows to a height of from 3 to 5 feet, being most productive at about 4 feet. Late planting and wet seasons sometimes cause the plant to run to weed, which may be checked by early planting, heavy manuring, deep preparation, and rapid and light cultivation early in the season, these being the most effective remedies.

The seed-cotton product on fresh land varies from 300 to 500 pounds on the pine lands to from 600 to 1,200 pounds on the river lands (1,425 to 1,545 pounds to the standard 475-pound bale). The staple rates from middling to good middling, from fresh land, to low middling from the worn land. By five or ten years' cultivation, without manure, the yield is reduced at least one-third and perhaps more. The most troublesome weed is crab-grass. The hog-weed is very abundant, but is more easily subdued. Only a small proportion of the river lands are turned out (from 5 to 10 per cent. of the other varieties), and they all improve by resting, producing for a few seasons after being reclaimed nearly as well as when fresh. The uplands are injured by washings, and the valleys are sometimes injured 25 per cent. from this cause. Horizontalizing and hillside ditching, when properly done, are efficient remedies.

Shipments of the cotton crop are made by river and by railroad to Columbus and Savannah, Georgia. The freight to Columbus or to Eufaula is 50 cents per bale; to Savannah, three-fourths of a cent per pound. The shipments are made from and after October 1.

LOWER PRAIRIE REGION, OR LIME-HILLS.

In this region are included parts of the following counties: Choctaw,* Washington,* Clark,* Monroe,* Conecuh,* Covington,* Crenshaw,* Geneva,* and Henry.*

CHOCTAW.

(See "Oak and hickory uplands, with long-leaf pine".)

WASHINGTON.

(See "Long-leaf pine region".)

CLARKE.

(See "Oak and hickory uplands, with long-leaf pine".)

MONROE.

(See "Oak and hickory uplands, with long-leaf pine".)

CONECUH.

(See "Oak and hickory uplands, with long-leaf pine".)

COVINGTON.

(See "Long-leaf pine region".)

CRENSHAW.

(See "Oak and hickory uplands, with long-leaf pine".)

GENEVA.

(See "Long-leaf pine region".)

HENRY.

(See "Oak and hickory uplands, with long-leaf pine".)

LONG-LEAF PINE REGION.

In this region are included parts of the following counties: Washington, Mobile, Clarke,* Baldwin, Monroe,* Conecuh,* Escambia, Covington, Geneva, Coffee,* Dale,* and Henry.*

WASHINGTON.

Population: 4,538.—White, 2,807; colored, 1,731.

Area: 1,050 square miles.—Woodland, all. Undulating pine lands, 800 square miles; lime-hills and shell-prairie lands, 150 square miles; pine hills, 100 square miles.

Tilled land: 8,936 acres.—Area planted in cotton, 3,280 acres; in corn, 4,259 acres; in oats, 464 acres; in rice, 67 acres; in sugar-cane, 90 acres; in sweet potatoes, 448 acres.

Cotton production: 1,246 bales; average cotton product per acre, 0.38 bale, 543 pounds seed-cotton, or 181 pounds cotton lint.

In the northern part of Washington county there is a belt, varying in width from 2 to 10 miles, in which lime-hills and prairies are the characteristic feature. The material upon which these soils depend for their origin is an impure whitish-gray limestone, having sometimes a greenish cast. This rock resembles to some extent the rotten limestone of the central prairie region, and like it, in disintegrating under the action of the weather, yields a grayish, waxy clay, which, mixed with vegetable matter, acquires a black color, like some of the central prairie soils.

This stiff black soil is difficult to till, but very fertile. Some parts of the rock crumble down into a fine, loose, black material called shell-prairie soil, in which are small pieces of the crumbling rock, sometimes filled with shells. This is one of the best of the lime-hills soils, rarely failing to bring good crops either of cotton or of corn. It is timbered with dogwood, black and white oaks, sweet gum, ash, short-leaf pine, and buckeye.

An intermixture of stiff calcareous clay with the red loam which forms the surface over the greater part of the northern portion of the county gives a stiff, mahogany-colored or yellowish soil, like the post-oak soil of the central region, and, like that, is timbered with post oaks and a few short-leaf pines, with occasionally a sweet gum and a hickory, all draped with the long moss. This soil, like the first named, is rather difficult to cultivate, but is highly productive. The prairie belt is very variable in width, and in places the piny woods extend entirely across it, while, on the other hand, narrow strips of prairie extend for miles out into the piny woods along some of the streams; and everywhere the prairie soils are interspersed with the sandy and loamy soil of the drift, which spreads over all the older rocks of this county and forms the great majority of the soils.

The topography of the lime-hills is quite characteristic. The hills are very steep, and have usually very little level land on top; but near the western border of the county it is not unusual to find as much as 100 acres in a body of tolerably level prairie land. As we go eastward these level tracts diminish in size and frequency, and the prairie belt consists of the genuine lime-hills. While under continuous cultivation the soil of the lime-hills does not wash so badly as might be expected from the steepness of the slopes, but when abandoned the bare rock very soon makes its appearance at the surface on the bald hill-tops.

Another variety of white limestone, geologically below that just described, underlies a very large part of Washington county, probably down to the Mobile county-line, but as a rule it does not take any prominent part in the formation of the soils, nor does it materially influence the topography.(a) Most of the territory underlaid by it is rolling or undulating piny woods with sandy soils and with subsoils of two kinds. The soils with yellow, sandy subsoil are very poor, the growth long-leaf pine, black-jack, turkey, and high-ground willow oaks; but where the subsoil is a little stiffer and of a reddish color the lands are very fair, and are timbered with Spanish and other upland oaks in addition to the long-leaf pine.

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a The historically, as well as geologically, well-known Saint Stephen's bluff is in its upper portion formed of this rock, while the other variety of limestone lies at the base of the bluff.

Near the state line, southwest of the prairie region, the land is a little more broken, passing westward in Mississippi into pine hills.

North of the lime-hills belt, in the extreme upper part of the county, there are other hilly pine lands, very poor, the surface of which is generally covered with fragments of sandstone and claystone (the latter usually called chalk). These chalk hills are best displayed in the lower part of Choctaw county, as only a very small part of Washington is of this character.

The creek-bottom lands throughout the lime-hills belt are good farming lands, as are also sometimes those of the chalk hills north of the prairies. This in the latter case is caused by the presence of marly beds, which are sometimes brought to the surface in the drainage valleys of the stream. In the rolling piny woods of the lower part of the county the bottoms are, as a rule, sandy, though generally productive for a time. The lowlands of the river, chiefly the second bottom, are good farming lands, the soil being a sandy loam, easy to till and productive. In certain localities it is improved by the calcareous washings of the uplands. The lower part of the county, while of little value for farming, affords a splendid pasturage for cattle.

The high yield per acre (0.38 bale) is due to the fact that most of the cotton is produced either upon the highly fertile river lands or the equally rich lime lands in the northern part of the county.

In the piny woods which forms so large a proportion of the area of the county the cultivation of cotton is not so profitable as stock-raising, timber-cutting, and the production of turpentine.

ABSTRACT OF THE REPORT OF R. M. CAMPBELL, SAINT STEPHENS, AIDED BY E. A. GLOVER, JOHN STARKE, AND OLIVER PRINCE.

There are three principal varieties of soil: First, upland sandy soil of gray to yellowish colors, covering over two-thirds of the county; second, river bottom, occupying a large portion of the townships on the eastern border of the county; and third, lime-lands (black prairie, shell prairie), occupying a large part of the northern tier of townships in the county.

The sandy uplands are timbered chiefly with long-leaf pine and black-jack, to which, in spots, the other varieties of oak and dogwood and hickory are added. Its soil is from 3 to 12 inches deep before its color changes to that of the subsoil, which is more clayey, easily permeable by water, but bakes hard when exposed to the sun where not cultivated, and contains, in places, concretions of ferruginous sandstone. This soil is easily tilled under all circumstances, and is always well drained.

The river bottom soil consists of a fine sandy loam on the river front, a heavy clay loam on stiff lands, and a putty-like loam on back land. The colors are brown, blackish to black, and thickness from 18 to 20 feet, below which sand has sometimes been noticed. White oak, ash, cottonwood, hickory, sweet gum, etc., are the prevailing trees. The land is easily tilled in wet or dry weather.

The lime-lands occupy a large part of the northern tier of townships in the county from the river westward. The natural growth is cedar, ash, hickory, oak, chestnut, etc. The soil is a heavy clay loam and a mellow shell prairie, putty-like in places, of gray, brown, and blackish colors, alternating or mixed; thickness, about 2 feet to the subsoil, which, where the lime-rock is not near the surface, is a tough yellow clay, turning black where cultivated (not otherwise), very impervious if not disturbed, and containing lumps of the lime-rock filled with sea shells. Beneath the subsoil there is, at depths varying from 2 to 10 feet, the lime-rock of the country. Tilling qualities easy after being once broken up, especially in dry seasons. The shell land is mellow, as is also the stiff land after being plowed in the spring. The soil is early and warm when well drained, which is effected only by ditching.

The soils of Washington county are well suited to cotton, to corn and other grains, and sweet potatoes, the former being cultivated upon two-thirds to three-fourths of the cultivated lands. On the uplands the average height of stalk is 3 feet; on the bottom and lime-lands 5 to 6 feet, and it is more productive the higher the stalk. Wet weather often causes the stalk to run to weed, especially on the shell prairies and lime-lands. Topping in July is the usual remedy, but some farmers think their mode of plowing avails. The average seed-cotton product of fresh land is from 300 to 600 pounds per acre on the uplands, 1,000 to 1,200 pounds on the lime-lands, and 1,300 pounds on the river lands, 1,545 pounds being needed to make a standard 475-pound bale, the staple of which rates from low middling to middling. After ten to twenty years' cultivation, without manure, the yield is reduced at least one-half on sloping or hilly lands, but not so much on the level bottoms, and about 1,600 pounds are needed to make a bale. There is no material deterioration of the fiber, except that it is thought to be a little shorter from worn land. Information on this point, however, is not definite. The troublesome weeds are crab-grass, Florida clover, morning-glory, and coffee-weeds, and cockleburs, tie-vine, and Indian potato or hog-root on the richer lands. From one-third to three-fourths of formerly cultivated lands are turned out (a less proportion of the lime-lands than of the others), and when again taken into cultivation they produce much better than when last tilled, but not quite so well as when fresh. The uplands and the lime-lands are injured by washes, especially the hill-tops, the valleys being usually rather benefited by the washings. The river lands are injured by water only by overflows. Little effort has been made to check this evil.

The cotton crop is shipped principally, by boat, to Mobile; rate of freight, $1 25 per bale. Shipping begins October 1, and usually lasts till January.

MOBILE.

Population: 48,653.—White, 27,187; colored, 21,466.

Area: 1,290 square miles.—Woodland, all except coast marshes. Rolling pine lands, 820 square miles; pine flats, 470 square miles.

Tilled land: 8,998 acres.—Area planted in cotton, 1 acre only returned; in corn, 1,639 acres; in oats, 139 acres; in rice, 191 acres; in sugar-cane, 151 acres; in sweet potatoes, 776 acres.

Cotton production: One bale returned.

The statistics above given show that Mobile county has a comparatively small area of cultivated land. With respect to its geological structure there is some uncertainty, though it seems probable that the white limestone underlies the greater part of the county, or at least the upper part as far south as Beaver Meadow and Chickasabogue, where lime-sinks show the presence of a limestone below the surface. The surface beds throughout, except in the extreme south, are the stratified drift and loam.

The county is gently undulating, though the water-sheds have considerable elevation above the sea. The Citronelle plateau, where crossed by the railroad, is 317 feet and the summit 333 feet above tide. All the drainage is into the Mobile river and bay on one side, and into the Escatawpa river on the other. The prevailing timber growth in the county is the long-leaf pine, which has been extensively cut for timber in all places where accessible to streams deep enough to float out the logs. The open pine woods afford most excellent pastures.

The characters of the principal soil varieties may be seen from the following abstract of the carefully written report of Professor J. P. Stelle, of Citronelle, which refers to the lands in the northern part of the county, the lowlands along the Mobile river and bay, and the uplands on the Citronelle plateau.

The river, the bay, and the railroads furnish ample facilities of transportation for the various products of Mobile county.

Cotton is not cultivated, except in small patches for home use, and the attention of the farmers is generally turned to the production of early vegetables and southern fruits for the market.

ABSTRACT OF THE REPORT OF PROFESSOR J. P. STELLE, OF CITRONELLE.

The soils are: First, the red sandy loam with clay subsoil, peculiar to all the upland plains; second, the dark loamy soil along the bottoms of Mobile and Tombigbee rivers; and third, the yellowish sandy loam along the western shore of the bay.

The chief soil is the first named, which is the soil of the uplands throughout the county. Its natural timber is predominately the long-leaf pine, but other trees, especially oaks, are not uncommon. The top soil is the usual sandy loam of whitish to gray, buff, orange, and blackish colors; thickness, 10 inches. The subsoil on the uplands is a red tenacious clay with a small proportion of sand, and makes good bricks. It contains in some places a few white rounded pebbles of quartz. Below the subsoil is sand, capped by a ferruginous sandstone at the depth of 10 to 20 feet. Vegetables for the northern market form the chief product of the soil.

The black bottom lands make one-eighth of the cultivated area in the region described. Its timber consists of oaks, hickory, elm, magnolia, bay, cypress, sweet and sour gums. The top soil is usually a clay loam with a good deal of vegetable matter, of dark to nearly black colors, and many inches in thickness.

The flat pine lands make an eighth of the cultivated area in question. Its timber consists mainly of long-leaf pine, with magnolia, bay, cypress, etc. The top soil is a sandy to clayey loam of a yellowish color 10 inches in thickness, with a yellowish clay loam as subsoil. It seems to be best adapted to the production of vegetables and fruits, oranges, etc. These three soils represent pretty nearly the different varieties occurring in the county.

CLARKE.

(See "Oak and hickory uplands, with long-leaf pine".)

BALDWIN.

Population: 8,603.—White, 4,890; colored, 3,713.

Area: 1,620 square miles.—Woodland, all except coast marshes; rolling pine lands, 900 square miles; pine flats, 720 square miles.

Tilled land: 7,698 acres.—Area planted in cotton, 1,384 acres; in corn, 2,041 acres; in oats, 350 acres; in rice, 121 acres; in sugar-cane, 81 acres; in sweet potatoes, 484 acres.

Cotton production: 638 bales; average cotton product per acre, 0.46 bale, 657 pounds seed-cotton, or 219 pounds cotton lint.

In physical and geological features Baldwin county resembles Mobile, which it adjoins on the east. The northern half of the county is more or less undulating, and is covered with a growth chiefly of long-leaf pine; the southern half is more level, and is timbered with the same tree and the Cuban pine. This general statement, however, is to be taken with some allowance, for between Mobile bay and the Perdido river, at Montrose, the water-shed is 200 feet above the bay, and it is the highest land on the coast between the Rio Grande and Navesink (*Haines*). The waters flow into the Perdido river on the east and into the Alabama and Mobile rivers and Mobile bay on the west. In the western part of the county, above the bay, is a considerable tract of marshy land in the delta of the river.

From the statistics, it will be seen that the county is rather thinly settled, and that a comparatively small proportion of the area is under cultivation. Much of the county is a natural pasture, and large herds of cattle and sheep are sustained, and, where accessible to streams, lumbering is an important industry.

All the cotton, or by far the greater proportion of it, is produced in the northern part of the county, and, as the high yield per acre shows, with the aid of fertilizers. Where cultivated, the cotton is shipped to Mobile by boat or by rail.

MONROE.

(See "Oak and hickory uplands, with long-leaf pine".)

CONECUH.

(See "Oak and hickory uplands, with long-leaf pine".)

ESCAMBIA.

Population: 5,719.—White, 4,106; colored, 1,613.

Area: 1,000 square miles.—Woodland, all. All rolling pine lands.

Tilled land: 6,934 acres.—Area planted in cotton, 278 acres; in corn, 3,699 acres; in oats, 869 acres; in sugar-cane, 83 acres; in rice, 405 acres; in sweet potatoes, 494 acres.

Cotton production: 94 bales; average cotton product per acre, 0.34 bale, 486 pounds seed-cotton, or 162 pounds cotton lint.

Escambia lies wholly within the long-leaf pine region. Geologically, its structure is simple. The white limestone of Vicksburg age underlies certainly the northern part and probably the whole of the county, though coming to the surface but rarely. Upon this are spread the materials of the stratified drift, which here, as in

so many other places, form the soils. The Conecuh and Escambia rivers, with their tributaries, drain the entire county, except a small portion of the northwest corner, which is drained by Little river, flowing into the Alabama, and another small portion in the southeast, drained by a tributary of Yellow river.

The county is, in general, a level pine woods, gently undulating and unbroken, save by the small valleys of the creeks and branches, and by occasional ponds and lime-sinks. The soil is uniformly a light sandy loam of prevailing light colors, and is comparatively poor. Along the Conecuh river especially there are bodies of good bottom or swamp land. The pine woods make here, as elsewhere, a fine natural pasture, and cattle-raising is an important industry. The magnificent pine timber is also a source of profit to many of the inhabitants. The high yield of the few acres planted in cotton shows that this staple is cultivated only in favored spots or with fertilizers.

ABSTRACT OF THE REPORT OF JOHN W. STEPHENSON, OF DOUGLASVILLE.

The upland soil is very thin, extending widely in vast unbroken tracts, and is not well suited to cotton unless manured. The owlands are quite productive, but are sometimes liable to overflow, and the crop is thus lost. For this reason the uplands are preferred, and with manure they give very fair returns. Since the war comparatively little cotton has been cultivated; it is planted upon most of the varieties of soil.

The most fertile soil is found in bodies of 5 to 10 acres along the Conecuh river bottom. The natural growth is spruce pine, oaks, hickory, chestnut, birch, etc. The soil is of the usual swamp or bottom-land character, with subsoil often containing pebbles, sometimes underlaid with the ferruginous sandstone so common in the stratified drift. In dry seasons this soil is easily tilled, but it is sometimes tilled with difficulty in wet weather. Corn, pease, and sweet potatoes are the most abundant crops, but cotton does well wherever tried. Very little is raised for the market, and no information is at hand concerning the quality of staple, etc. On account of its position, this kind of land seldom suffers from washing. Rag-weed is one of the most troublesome weeds.

Cotton is shipped by rail to Mobile or Montgomery.

COVINGTON.

Population: 5,639.—White, 4,968; colored, 671.

Area: 1,030 square miles.—Woodland, all. Undulating or rolling pine lands, 720 square miles; lime-hills, 50 square miles; pine uplands, 260 square miles.

Tilled land: 19,326 acres.—Area planted in cotton, 4,176 acres; in corn, 10,558 acres; in oats, 2,114 acres; in rice, 47 acres; in sugar-cane, 147 acres; in sweet potatoes, 466 acres.

Cotton production: 1,158 bales; average cotton product per acre, 0.28 bale, 399 pounds seed-cotton, or 133 pounds cotton lint.

The rocky substratum of Covington county is made up of the strata of two of the groups of the Tertiary formation, viz, the Jackson and the Vicksburg. The white limestone of the latter group is exposed where the overlying drift materials have been removed by denudation throughout the whole county, except, perhaps, the extreme southern portion. As a rule, this rock is too deeply covered with the drift sands and loam to have much influence upon the soils, except in a few areas of limited extent, where red lime-lands similar to those of the adjoining county of Conecuh are found in the upper part of the county. Otherwise, the upland soils are of the usual varieties afforded by the stratified drift. The soils, therefore, are upland sandy loams of varying degrees of fertility, but usually light, forming the great bulk of the lands. These have a growth of long-leaf pine, alternating with the various species of upland oaks. The pines occupy, in general terms, the higher areas, while the oaks and hickories are found more frequently along the drainage slopes of the streams; positions determined in great measure probably by the varying proportions of sand in the soils from which these trees derive their sustenance. Upon the higher lands, where by the long-continued action of the rains the specifically lighter materials constituting the clay have been carried down from the surface, the sandier portions are left to form the soil. Upon slopes, however, where running water has been active, both the lighter and heavier materials are removed together, and the original loamy character of the drift deposits has been preserved more or less unchanged.

Upon the nearly level gently undulating areas in the lower part of the county vast forests of long-leaf pine prevail, with an undergrowth of grass and leguminous plants, which afford pasturage for great numbers of cattle, sheep, and swine. The forests themselves, where accessible, are heavily drawn upon for timber.

The bottom lands are of the usual character, and are generally fertile. From their liability to overflow, however, they are often less desirable than the uplands, where, with a moderate outlay for fertilizers, good crops of cotton are almost certain to be made. The chemical nature of the pine upland soils is very well seen in the analysis given on page 55 of a soil from 13 miles east of Andalusia. These soils, like the sandy, rather infertile soils of the Coal Measures and parts of the older formations of the state, while intrinsically poor, are yet rapidly coming into use with fertilizers.

Agriculturally, Covington county is like Conecuh, with the exception that the lime-lands here are of very limited extent, and nearly the whole county has the character of the long-leaf pine lands.

The cotton from this county is usually shipped from Troy, Greenville, or Evergreen, to which markets it must be hauled great distances in wagons.

GENEVA.

Population: 4,342.—White, 3,829; colored, 513.

Area: 590 square miles.—Woodland, all. Undulating pine lands, 560 square miles; red lime-lands, 30 square miles.

Tilled land: 17,664 acres.—Area planted in cotton, 4,947 acres; in corn, 9,476 acres; in oats, 1,705 acres; in sugar-cane, 118 acres; in rice, 54 acres; in sweet potatoes, 350 acres.

Cotton production: 1,112 bales; average cotton product per acre, 0.23 bale, 327 pounds seed-cotton, or 109 pounds cotton lint.

Geneva county is underlaid throughout its entire extent with the white Vicksburg limestone, which, as usual, exerts comparatively little influence on the cultivable soils. Exception to this is noticed in the eastern part of

the county, in the drainage area of the Chipola river, where a fine lime-land is well known for its fertile character. This sort of calcareous soil is much more prevalent in the adjoining county in Florida, whose red lime-lands have a wide reputation.

The arable soils are in great measure derived from stratified drift and loam, and exhibit the usual varieties. The proportion of red or yellow loam in the soil and subsoil seems to decrease, in general, as we go south, and the proportion of sand to increase in the same direction. Between Millville and Geneva the various species of oaks are associated with the long-leaf pines, showing a very fair quality of soil. Northwest of Geneva, along the divide between Double Bridges creek and Pea river, pine woods, with scarcely any admixture of other trees, prevail; but occasionally upland willow and small post and black-jack oaks are associated with the pines, constituting a regular pine-barren growth. Coarse tufts of wire grass form the undergrowth almost universally, except in the numerous boggy places, where a rich and peculiar flora is commonly seen.

Until a few years past the cultivation of cotton in this county has received very little attention, the inhabitants being chiefly engaged in the lumber business and in cattle and sheep raising. With the use of guano these pine lands bring very fair crops, often a bale to 2 acres.

With the exception above noted of a small area of lime-lands in the southeastern part of the county, the pine woods form all the uplands of Geneva. The composition of the soil is similar to that of the Covington county soil (analysis given on page 55), which is, however, a better soil than that of the average pine woods.

The white orbitoidal limestone of the Vicksburg age is to be seen in many localities in Geneva where the drainage has removed the overlying sands, as along the banks of the Choctawhatchee river and other large streams. This river is navigable to the town of Geneva, and was formerly one of the principal outlets for the products of the county. Most of the timber still finds its way to market by this stream, though the cotton is now hauled in wagons to Troy, at a cost of $2 50 per bale.

ABSTRACT OF THE REPORT OF W. N. BRANDON, OF GENEVA.

The lowlands are the dark-gray bottom lands, sand hummocks, and gallberry flats. The uplands vary from light gray to red, according to the proportion of loam which is mixed with the sand, and are preferred, as the cotton can be planted earlier, with consequently less liability to damage from early frosts and worms. The river lands are nearly all subject to overflow, and are not so certain.

The gray upland soils have a yellowish subsoil down to the clay (reached at 18 inches), and the mahogany and red soils have a red subsoil. The timber is long-leaf pine, with post oak, hickory, broad-leaf black-jack, red oak, etc. These soils are early, warm, and well drained, and are well suited to cotton, corn, sugar-cane, rice, potatoes, etc.

About half the cultivated area about Geneva is in cotton, which usually grows to a height of 3 feet. When planted late, and in wet seasons, there is a tendency to go to weed, which is restrained by planting early, using fertilizers, and by working fast and early. The average yield of seed-cotton on fresh land is from 600 to 700 pounds to the acre, which is brought down to 400 pounds after five years' cultivation without manure. To make a 475-pound bale 1,485 pounds of seed-cotton are needed. The staple rates as middling from the fresh to low middling from the worn land, though there is usually very little difference in the quality. Hog-weeds are (exclusive of grasses) most troublesome to the farmer. One-fourth of the land originally cultivated lies turned out, but after a rest of some years, especially if cattle have been kept off, if taken again into cultivation, it produces well. The damage from washings is not very great and no efforts have been made to check it, except in a few instances, where horizontalizing and hillside ditching have been practiced with good results.

The sandy hummocks are found along the Choctawhatchee river, and are considered best for corn, only about a fifth of the lands being in cotton.

COFFEE.

(See "Oak and hickory uplands, with long-leaf pine".)

DALE.

(See "Oak and hickory uplands, with long-leaf pine".)

HENRY.

(See "Oak and hickory uplands, with long-leaf pine".)

ALLUVIAL REGION.

This region includes parts of Washington,* Clarke,* Mobile,* and Baldwin* counties.

WASHINGTON.

(See "Oak and hickory uplands, with long-leaf pine".)

CLARKE.

(See "Oak and hickory uplands, with long-leaf pine".)

MOBILE.

(See "Long-leaf pine region".)

BALDWIN.

(See "Long-leaf pine region".)

PART III.

CULTURAL AND ECONOMIC DETAILS OF COTTON PRODUCTION.

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REFERENCE TABLE

OF

REPORTS RECEIVED FROM ALABAMA COUNTIES.

I.—METAMORPHIC REGION.

1. *Cleburne.*—JOHN R. MOTIS, Edwardsville, March, 1880. Location, township 14, range 11, section 34. Describes first and second-bottom lands of Cane creek.
2. *Cleburne.*—JAMES H. BELL and DAVID V. CRIDER, Arbacoochee, April, 1880. Location, township 16, range 10, section 11. Describe bottom lands on creeks and on the Tallapoosa river.
1. *Randolph.*—JAMES H. RADNEY, Roanoke, April, 1880. Location, township 21, range 12. Describes first and second bottoms on Highpine and Cornhouse creeks.
1. *Lee.*—JOHN T. HARRIS, Opelika, August, 1880. Describes lands on Hallawaka creek and Chattahoochee river.
2. *Lee.*—C. H. MCCULLOH, Beulah, May, 1880. Location, township 20, range 29, section 20. Describes first bottom of Hallawaka creek and Chattahoochee river.
1. *Tallapoosa.*—D. A. G. ROSS, Camp Hill, April, 1880. Location, township 21, range 24, sections 27 and 34. Describes bottom lands on Sandy creek.
2. *Tallapoosa.*—DANIEL TAYLOR, New Site, March, 1880. Location, township 24, range 23. Describes bottoms and uplands on Emuckfaw creek and Tallapoosa river.
3. *Tallapoosa.*—JAMES M. PEARSON, Dadeville, May, 1880. Location, township 22, range 23, section 36. Describes lands on Sandy creek.
1. *Clay.*—WILLIAM W. JENKINS, Hillabee, January, 1882. Location, township 20, range 7. Describes lands on Talladega, Buzzard, Hillabee, Hatchet, and other creeks.
1. *Coosa.*—J. C. MCDIARMID, Good Water, April, 1880. Location, township 20, range 22, sections 24 and 25. Describes bottoms and uplands on Hatchet creek and Coosa river.
2. *Coosa.*—JOHN S. BENTLEY, Rockford. Describes bottoms and uplands on Socopatoy, Jacko, and Big and Little Hatchet creeks, all tributaries of the Coosa river.

II.—COOSA VALLEY REGION.

Cherokee.—Dr. JOHN LAWRENCE, Cedar Bluff, January, 1882. Describes lowlands on Coosa, Chattooga, and Little rivers, and Terrapin and other creeks, and uplands adjacent.

1. *Calhoun.*—Dr. S. C. WILLIAMS, Oxford, August, 1880. Location, townships 14, 15, 16, 17, ranges 7, 8, 9, section 19. Describes bottom lands on Choccolocco creek and Coosa river and neighboring uplands.
2. *Calhoun.*—T. W. FRANCIS, Cane Creek, June, 1880. Location, township 15, range 6. Describes lowlands and uplands on Cane creek and Coosa river.
1. *Etowah.*—W. B. BEESON, Greenwood, May, 1880. Describes uplands on Wills' Creek.
1. *Saint Clair.*—JOHN W. INZER, Ashville, July, 1880. Location, township 14, range 4, section 7. Describes second bottoms and hill lands on Big Canoe creek and Coosa river.
1. *Talladega.*—H. M. BURT, Talladega.
2. *Talladega.*—S. M. JEMISON and A. W. DUNCAN, Talladega, July, 1880. Describe bottoms and uplands on Choccolocco, Talladega, Cheahhah, Wewoka, and Tallasahatchie creeks.

Shelby.—T. A. HUSTON, Wilsonville. Describes land on several small creeks flowing into the Coosa river.

III.—COAL-MEASURES REGION.

Cullman.—WILLIAM J. DUNN, Cullman, April, 1880. Location, township 10, range 3 west, section 15. Describes bottoms and uplands on the Warrior river.

Blount.—GEORGE D. SHELTON, Brooksville, June, 1880. Location, township 10, range 2 east, section 13. Describes bottoms and uplands on Big Spring and Slab creeks and Warrior river.

Winston.—F. C. BURDICK, Houston, March, 1880. Location, townships 9, 10, 11, 12, ranges 6 to 10 west. Describes bottoms on Yellow creek and Sipsey river, and uplands on Bushy and Clear creeks and Sipsey river.

IV.—TENNESSEE VALLEY REGION.

Jackson.—W. F. HURT, Bellefonte, July, 1880. Location, township 3, range 6, section 21. Describes bottoms and table-lands on Mud creek and Tennessee river.

1. *Madison.*—THOMAS B. KELLY, Cluttsville, May, 1880. Location, townships 1, 2, 3, 4, 5, ranges 1, 2, 3 west. Describes first bottoms on Tennessee river and hilly and mountainous uplands.

2 *Madison.*—WILLIAM C. IRWIN, Huntsville, May, 1880. Describes bottoms and uplands on Indian and Spring creeks and Tennessee river.

3. *Madison.*—GEORGE D. NORRIS, New Market, March, 1880. Location, township 1, range 2 east, section 32. Describes lowlands and uplands on Mountain Fork and Flint rivers and alluvial plains on Hester's creek and Flint river.

1. *Limestone.*—F. H. PEEBLES, Mooresville, November, 1881. Location, township 4, range 3 west, sections 5, 6, 7, 8. Describes uplands and lowlands on Piney, Limestone, and Beaver Dam creeks.

1. *Lauderdale.*—JAMES WILLIAM MORGAN, Florence, June, 1880. Location, township 3, range 13. Describes bottoms on Tennessee river.

2. *Lawrence.*—JAMES E. SAUNDERS and F. W. SYKES, M. D., Town Creek, April, 1880. Location, township 4, range 8, sections 21, 22. Describe level mulatto lands on Town creek and Tennessee river.

1. *Colbert.*—L. B. THORNTON, Tuscumbia, January, 1880. Describes lowlands in Tennessee valley and table-lands on Big Bear creek.

2. *Colbert.*—T. B. BICKLEY, Spring Valley, March, 1880. Location, township 4, ranges 10, 11, sections 19, 25. Describes uplands on Spring creek.

Franklin.—Dr. DANIEL N. SEVIER, Russellville, July, 1880. Describes bottoms and uplands of Cedar creek.

V.—OAK AND PINE UPLANDS.

(Including: 1. Oak and hickory uplands, with short-leaf pine. 2. Gravelly hills, with long-leaf pine.)

Marion.—MARTIN NESMITH, Pikeville, June, 1880. Location, township 12, range 13, section 32. Describes bottoms and uplands on Beaver and Buttahatchie creeks.

Lamar.—GEORGE E. BROWN, Carslen, December, 1880. Location, townships 12, 13, ranges 14 and 5. Describes lands on Beaver and Buttahatchie creeks.

1. *Pickens.*—M. F. COOK, Pickensville, March, 1880. Location, townships 20, 21, ranges 15, 16, 17. Describes bottoms and uplands on Coalfire creek and Bigbee river.

2. *Pickens.*—R. F. HENRY, Columbus, Mississippi, January, 1880. Location, township 18, range 16. Describes lowlands and uplands on McBee creek and Tombigbee river.

1. *Tuscaloosa.*—A. C. HARGROVE, Tuscaloosa, June, 1880. Location, township 21, ranges 10, 11, sections 7, 18, 19, 30, 25, 13. Describes lowlands on Warrior river and adjacent uplands.

2. *Tuscaloosa.*—JAMES R. MAXWELL, Tuscaloosa, July, 1880. Location, township 24, range 5 east, section 3. Describes rolling bottom lands between Big creek and Warrior river and uplands on Little Sandy river.

Bibb.—J. S. HANSBERGER, Tionus, March, 1880. Location, township 24, range 10 east.

Autauga.—C. M. HOWARD, Mulberry, August, 1881. Location, township 17, range 13. Describes bottoms and uplands on Beaver and Ivy creeks.

VI.—CENTRAL PRAIRIE REGION, INCLUDING FLATWOODS.

Sumter.—Dr. R. D. WEBB, Livingston, March 9, 1880. Describes the black prairie, the upland sandy, and the post-oak flatwood soils occurring in the drainage area of Sucarnatchie creek, a tributary of the Tombigbee river.

Greene.—THOMAS J. PATTON, Knoxville, July, 1880. Location, township 23, range 3 east. Describes uplands and lowlands on Sims and Buck creeks and the Warrior river.

1. *Hale.*—Professor TUTWILER, Greene Springs, May, 1880. Location, township 22, range 4 east. Describes lands on Five-mile creek and Warrior river.

2. *Hale.*—NORFLEET HARRIS, Laneville, March, 1880. Location, township 18, range 5 east. Lands are for most part black and chocolate prairie.

Marengo.—W. A. STICKNEY, Faunsdale, June, 1880. Location, township 17, range 5 east, sections 8, 17, 20. Describes rolling and flat, loose black prairie uplands, and mulatto or post-oak lands on and near Cottonwood and Powell creeks.

Perry.—H. A. STOLLENWERCK, Uniontown. Location, township 18, range 6, sections 18, 20. Describes first bottoms and rolling and level prairie lands on Dry creek.

Dallas.—J. F. CALHOUN, Minter, February, 1882. Location, township 13, ranges 10, 11, sections 11, 14, etc. Describes uplands between Cedar and Pine Barren creeks.

1. *Lowndes.*—WILLIAM M. GARRETT, Mount Willing, March, 1880. Location, township 13, ranges 13, 14. Describes bottoms and black prairie and sandy uplands on Cedar creek.

2. *Lowndes.*—P. T. GRAVES, Burkville, September, 1880. Location, township 16, range 15, section 36. Describes uplands on Tallawassee and Pintlala creeks.

1. *Montgomery.*—THOMAS W. OLIVER, Montgomery, April, 1880. Location, township 16, range 18, sections 8, 18, 17. Describes bottoms on Small creek and uplands on Catoma creek.

2. *Montgomery.*—J. A. CALLAWAY, Snowdoun, March, 1880. Location, township 15, range 18. Describes bottoms and uplands on Ramer and Catoma creeks.

1. *Bullock.*—W. M. STAKELY, Union Springs, March, 1880. Location, township 14, range 23, section 4. Describes uplands and hog-wallow prairies on Cupiahatchee and Town creeks.

2. *Bullock.*—J. F. CULVER, Union Springs, January, 1880. Location, township 13, ranges 23, 24. Describes sandy and black prairie bottoms on the headwaters of Conecuh river.

3. *Bullock.*—J. L. MOULTRIE, Union Springs, March, 1880. Location, township 14, range 23, sections 23–26. Describes timbered prairie or post-oak lands on the Cupiahatchee creek.

4. *Bullock.*—M. H. STINSON, Union Springs, March, 1880. Location, townships 11, 12, 13, ranges 23, 24. Describes bottoms and uplands on Conecuh and Pea rivers.

Macon.—JOHN L. COLLINS, Tuskegee, December, 1881. Refers to entire county.

1. *Barbour.*—Hon. H. D. CLAYTON, Clayton, September, 1880. Location, township 10, range 26, sections 4, 5, 8, 9. Describes first and second bottoms and rolling uplands on Choctawhatchee creek and river.
2. *Barbour.*—Dr. H. HAWKINS, Hawkinsville, March, 1880. Describes bottoms and uplands on Cowikee and other creeks, and on the Chattahoochee river.

VII.—LONG-LEAF PINE REGION.

(Including: 1. Oak and hickory uplands, with long-leaf pine. 2. Lime-hills or lower prairie. 3. Open pine woods and lime-sink region.)

1. *Washington.*—R. M. CAMPBELL, Saint Stephens, June, 1880. Location, townships 3, 4, 5, 6, 7, 8, range 1 east, and ranges 1, 2 west. Describes bottoms and alluvial lands on the Tombigbee river, and rolling and level uplands on Lewis and Sinta Bogue creeks.
1. *Monroe.*—J. M. HARRINGTON, Newtown Academy, July, 1880. Location, township 9, range 9, section 16. Describes bottoms and uplands on Flat creek.
1. *Wilcox.*—HENRY C. BROWN, Camden, January, 1880. Location, township 12, range 8, section 33. Describes bottoms and uplands on Pursley creek.
2. *Wilcox.*—FELIX TAIT, Camden, April, 1880. Location, township 11, range 7. Describes lands on the Alabama river.
1. *Conecuh.*—ANDREW JAY, sr., Jayvilla, February, 1880. Location, township 5, range 12, section 30. Describes lands on Murder creek and Escambia river.
2. *Conecuh.*—P. D. BOWLES, Evergreen, February, 1880. Location, township 5, range 11, section 11. Describes bottoms and uplands on Beaver creek and Conecuh river and alluvial plains on Murder creek.

Crenshaw.—GEORGE W. THAGARD, Rutledge, January, 1880. Location, townships 9, 10, range 17. Describes bottoms and uplands on Patsaliga river.

Coffee.—M. G. STOUDENMEIER, Elba, July, 1880. Describes rolling and level lands on Boles creek and Pea river.

Dale.—J. C. MATTHEWS.—Crittenden's Mills, January, 1880. Location, townships 3 to 8, ranges 23 to 28. Describes bottoms and uplands on Choctawhatchee river and several tributary creeks.

Henry.—A. MCALLISTER, Shorterville, March, 1880. Location, township 7, range 29. Describes bottoms on Choctawhatchee and uplands on numerous creeks.

Mobile.—J. P. STELLE, Citronelle, June, 1880. Describes lowlands and uplands on Mobile and Tombigbee rivers.

Escambia.—JOHN W. STEPHENSON, Douglasville, April, 1880. Location, townships 1, 2, ranges 11, 12. Describes lands on Conecuh river.

Geneva.—W. N. BRANDON, Geneva, August, 1880. Location, townships 2, 3, ranges 22, 23. Describes bottoms and uplands on Wilkinson creek.

ANSWERS TO SCHEDULE QUESTIONS.

[The Roman numerals used in the following answers refer to the regions as numbered in the reference table.]

These regions are—

I.—Metamorphic.
II.—Coosa and outlying valleys.
III.—Coal-fields.
IV.—Tennessee valley.
V.—Oak and pine uplands, including—
1. Oak and hickory uplands, with short-leaf pine.
2. Gravelly hills, with long-leaf pine.
VI.—Central prairie region, including—
Flatwoods.
VII.—Long-leaf pine region, including—
1. Oak and hickory uplands, with long-leaf pine.
2. Lime-hills or lower prairie.
3. Open rolling pine woods and lime-sink region.

TILLAGE, IMPROVEMENTS, ETC.

1. Usual depth of tillage (measured on land side of furrow).

The average depth in all the regions is 3 to 4 inches.

2. What draft is employed in breaking up?

Generally one horse or mule.

3. Is subsoiling practiced? If so, with what implements, and with what results?

To some extent, and usually with good results, in regions I, II, III, and IV; rarely, if at all, in the last three regions.

4. Is fall plowing practiced? With what results?

Practiced to a limited extent in I, II, III, and IV, and with good effect in certain parts of the Tennessee valley; rarely, if at all, used in VI and VII. Where cotton is the chief crop, all the labor is required in the fall for gathering. In VII the character of the soil is generally of such nature that fall plowing would not be remunerative.

5. Is fallowing practiced? Is the land tilled while lying fallow or only "turned out"? With what results in either case?

Fallowing is practiced but little, if at all, except in small areas in regions II and III. Throughout the state, however, it seems to be very common for land to be "turned out" to rest.

6. Is rotation of crops practiced? If so, of how many years' course, in what order of crops, and with what results?

Rotation of crops is practiced throughout the state, but not always in a systematic way. Where there is system, the usual order of crops is cotton from one to three or four years, then corn, followed by oats, or wheat, to be followed again by cotton. In regions V, VI, and VII cotton is generally the chief crop, and all the best and freshest land is devoted to its culture. In these regions it is no unusual thing for the same lands to be planted in cotton five, ten, or fifteen years in succession. In some parts of the Tennessee valley it is becoming quite common to sow clover with small grain, so that the order of crops is cotton, corn, oats, or wheat, with clover, followed by one or two years' of rest.

7. What fertilizers or other direct means of improving the soil are used by you or in your region? With what results? Is green-manuring practiced? With what results?

In I, II, VI, and VII guano, the superphosphates, and compost, with cotton-seed and stable manure, or with lime, vegetable matter, etc., are chief manures, and the results are always good, provided the crops are properly cultivated. In III, IV, and V there is less use of commercial fertilizers, but on the contrary, cotton-seed and cottonseed-meal are used over a large part of this area to a very considerable extent. In all cases where fertilizers are properly applied and the crops are thoroughly cultivated, it appears that farmers are fully repaid for the outlay made in their purchase. There is but little green-manuring; but in some localities cow-pease, weeds, grass, etc., are turned under with advantage. On lime-lands pease cannot be profitably or safely used.

8. How is cotton-seed disposed of? If sold, on what terms, or at what price? Where is the nearest cottonseed-oil factory? Is cottonseed-cake used for feed; for manure?

Cotton-seed is used throughout the state as a fertilizer, both in the green state and in the form of meal. It is also used in both forms as a feed for cattle; the cake or meal is, however, not yet much used for feeding. As an article of commerce seed is disposed of principally to the oil-mills, of which there are quite a number in this state. The negroes, as a rule, sell their cotton-seed to the mills, but the more thrifty and intelligent planters find it advantageous to return all surplus seed to the soil. The seed, both in its natural and manufactured forms, is especially valuable for corn and all small-grain crops. But, except some small areas, the cottonseed-cake is not much used either alone or mixed, for crops, probably because of its cost.

PLANTING AND CULTIVATING OF COTTON.

9. What preparation is usually given to cotton land before bedding up? Do you plant in ridges; how far apart? What is the usual time of planting? What variety of seed is preferred? How much is used per acre?

Throughout the state there is but little preparation given to land before bedding it for cotton, except the removal of the stalks of the old crop; but in exceptional cases the land is plowed broadcast in the winter or early spring. Cotton is uniformly planted in ridges, which are from 2½ to 4 feet apart, according to the strength of the soil. In regions I, II, III, and IV cotton is planted from the 10th of April to the 1st of May; in the other regions the time of planting is on the average from five to fifteen days earlier. There are numerous varieties of seed used. Among others may be mentioned Dixon, Boyd Prolific, Peeler, Zellner, Brown, Green, Petit Gulf, etc. According to some reports the cluster or short-limb varieties are best suited to deep soils, and long-limb varieties do best on light or thin soils. The average amount of seed required per acre is from two to three bushels, more being required for early than for late planting. It appears that in some cases the minimum may be as low as one bushel and the maximum as high as six bushels of seed per acre.

10. What implements do you use in planting? Are "cottonseed-planters" used in your region? What opinion is held of their efficacy or convenience?

As a rule, the bed or ridge is opened with a narrow plow (scooter or bull-tongue), and the seed is strewn in the furrow by hand, and covered with a board, bleck, or harrow. Planters are but little used, and yet their use secures a uniform distribution of seed in the drill, and hence economizes seed, and also makes the after-cultivation more easy.

11. How long usually before seed comes up? At what stage of growth is it thinned out to a stand, and how far apart? Is cotton liable to suffer from "sore-shin"? What after-cultivation is given, and with what implements?

Seed comes up in from five to twenty days, and is usually thinned out to a stand when three or four weeks old, or when the third and fourth leaves appear. The young plant is sometimes retarded in growth by the "sore-shin", which is specially the case in cold and wet weather. The injury seems to be caused in the first instance from carelessness or want of skill in the use of the hoe, by which the bark of the plant is either abraded or cut. The first after-cultivation consists in most cases, perhaps, in "running" round the cotton with a turning-plow, bar side to the drill, after which the cotton is chopped out and generally brought to a stand with one or two stalks in a hill, at distances varying from 12 to 18 or 20 inches in the drill, according to fertility of soil. After having been brought to a stand, cotton usually has simply surface culture with sweep, harrow, or cultivator.

12. What is the height usually attained by cotton before blooming? When are the first blooms seen? When do the bolls first open? When do you begin your first picking?

The height attained before blooming is from 1 to 3 feet, according to the character and preparation of the soil. The first blooms appear when the cotton is 8 or 9 weeks old, and hence from June 10 to July 4, the former date being generally true for V, VI, and VII regions and the latter for the remainder of the state. The interval from the bloom to the opening of the boll is from 40 to 50 days, the shorter interval being required later in the season. Hence, cotton begins to open from the last of July to the middle of August, and picking usually begins two or three weeks afterward.

13. How many pickings are generally made, and when? Do you usually pick all your cotton? At what date does picking usually close? At what time do you expect the first "black frost"? Do you pen your seed-cotton in the field, or gin as the picking progresses?

As a rule there are three pickings, by which all the crop is gathered. Picking generally closes by the last of November; but when the yield is heavy, or labor insufficient or inefficient, the picking may not be finished till Christmas. Black frost is said to occur from October 10 to the 1st of November, according to the nature of the locality and the character of the season. In some cases seed-cotton is penned in the field, which is generally quite hazardous. The usual practice is to have cotton ginned, if possible, as the picking progresses.

GINNING, BALING, AND SHIPPING.

14. What gin do you use? How many saws? What motive power—horse-power or steam-engine? If the latter, which mechanical power arrangement do you prefer?

There are many answers to the first question. Some of the many gins mentioned are Pratt's, Gullett's, Winship's, Orr's, Brown's, Carver's, Avery's, Loomis', Eagle, and Magnolia. In a few cases steam is the motive power, and still more rarely water is the agent. Generally horses or mules are used to drive the gin. The gearing consists usually of wooden cog-wheels or iron segments with pinion. The only thing in the way of a general use of steam is the cost of engine and fixtures. Its use is of course advantageous in many respects. The great majority of the gins in use have from 40 to 50 saws.

23. Which system (wages or share) is the better for the laborer? Why? What is the condition of the laborers? What proportion of negro laborers owns land or the house in which they live?

There is a very decided difference of opinion as to which is the better system (wages or share). With the exception of regions IV, V, and VI, opinions are about equally divided; in these, however, there is almost entire concurrence in the opinion that wages are the best. The reasons assigned in favor of wages are, that the laborer is sure of reward and a comfortable living, and the employer is enabled to control labor, and is justified in making larger expenditures in fertilizers, etc., to increase the yield. It is urged in favor of the shares system that the laborer is encouraged to make effort, and that if he is industrious and energetic he will be rewarded with larger returns for his labor. On the whole, the condition of the laborers is good—better, perhaps, than that of the same class of persons in any other quarter of the globe. Very few negroes own houses or lands in the large farming regions.

24. What is the market value of land described in your region? What rent is paid for such land? How many acres or 400-pound bales per hand is your customary estimate?

Cotton lands, in the greater part of the state, are estimated in value at $3 to $10 and $12, while in a few localities, such as Perry, Marengo, etc., in region VI, and the best lands in the Tennessee Valley region are estimated at $15, $20, $30, and in some few cases even higher. Rent varies partly in proportion to the estimated value of the land, and hence the price of rent is from $1 and less to $2, $3, and sometimes $4 per acre. Rent is also paid in produce at the rate of one-fourth of the cotton and one-third of the corn grown on the land. According to quality of land, the estimate of product per hand will vary from 2 to 6 bales, but the average for good land is 3 to 4 bales per hand. In some cases the estimate is made at 6 to 10 bales per mule, *i. e.*, one mule and two hands.

25. To what extent does the system of credits or advances upon the growing crop prevail in your region? At what stage of its production is the cotton crop usually covered by insurance? Is such practice general?

In region I credits to the value of one-half the laborer's crop are often made by land-owner; in region II credits are given largely in a few localities, but not as much as formerly; in region III credits have only recently been asked and granted; in regions IV, V, VI, and VII credits are almost universal, and regularly consume the entire crop of the laborer. As a rule, the crop is not insured till shipped or placed in the warehouse for shipment. In a few cases cotton is insured when baled, and in some parts of Bullock county gin-houses and cotton are insured as soon as picking begins. Cotton is always insured when shipped, unless forbidden by the owner.

26. What are the merchants' commissions and charges for storing, handling, shipping, etc., to which your crop is subject? What is the total amount of these charges against the farmer per pound, or 400-pound bale? What is your estimate of the cost of production in your region, exclusive of such charges, and with fair soil and management?

When the producer pays all the expenses of shipping, handling, storing, and commissions for selling, his expense or loss is from $4 to $6 per bale, but when he sells to a home merchant he often pays only for the weighing; the buyer incurs the additional expense. It is quite general over large areas of this state for the farmer to sell his cotton at the nearest town, store, or depot. The report of cost of production is almost invariably 8 cents per pound. A few seem to think that cotton can be produced at a cost of 5 or 6 cents, while a very few estimate the cost of production at 10 to 12½ cents per pound.

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REPORT

ON THE

COTTON PRODUCTION OF THE STATE OF FLORIDA,

WITH AN ACCOUNT OF

THE GENERAL AGRICULTURAL FEATURES OF THE STATE.

BY

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SPECIAL CENSUS AGENT.

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LETTERS OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,
CENSUS OFFICE,
Berkeley, California, October 31, 1881.

Hon. FRANCIS A. WALKER, *Superintendent of Census.*

DEAR SIR: I have the honor to transmit herewith a report on the cotton production and agricultural features of the state of Florida, by Dr. Eugene A. Smith, special agent in charge of the subject for the states of Alabama and Florida.

In view of the very imperfect and fragmentary data regarding the natural features of Florida thus far accessible to the public, and of the growing interest in the inducements offered to the immigrant by this semi-tropical region, it has been thought desirable to accord to it a somewhat more detailed consideration than would be called for in the case of the states whose accessibility by railroads and comparatively dense population have made their general features more familiar. Since, moreover, the personal explorations of Dr. Smith have resulted in very important additions to our knowledge of the geological structure of the state which has been to a great extent misunderstood, this portion of the subject has likewise received more scope than will be given it in the case of the states in which geological surveys have heretofore been made and reported on.

A map showing the several agricultural regions, and one showing the acreage in cotton, accompany the report.

Very respectfully, your obedient servant,

EUG. W. HILGARD,
Special Agent in charge of Cotton Production.

UNIVERSITY OF ALABAMA,
Tuscaloosa, October 15, 1881.

Dr. EUGENE W. HILGARD,
Special Agent Tenth Census, in charge of Cotton Production.

DEAR SIR: I have the honor to submit herewith my report upon cotton production in the state of Florida, in the form of tabular statements of the enumeration results, together with a general account of the physical geography, geology, and agricultural features of the state.

To this are added special agricultural descriptions of the counties, in which it has been attempted to present the most important features of each in such a form as to be of service to the general reader as well as to the immigrant.

In the general arrangement of the subject-matter I have followed the plan adopted by yourself in the report on Louisiana, viz:

1. Tabulated results of the enumeration, showing acreage and production of the leading crops.
2. An outline of the physical geography and geology of the state.

In view of the circumstance that so little has been published on Florida geology, I have, at your suggestion, prepared a measurably complete *résumé* of what has hitherto been done in this field, together with a synopsis of the results obtained by me during the summer of 1880 while engaged in the collection of statistics for the present report.

3. A description of the agricultural subdivisions or regions, with analyses of characteristic soils, etc., and their discussions. With one or two exceptions these analyses were made for the Census Office under my immediate supervision.

4. A general account of cotton production in Florida, with comparisons of the long and short staple varieties and discussions of the enumeration results which relate to the production of cotton. The tabulated results of the enumeration are given in this connection, showing population and cotton production in each agricultural region of the state, "banner counties" as regards production and product per acre in each agricultural region, and area, population, and cotton production of the several counties, arranged according to agricultural regions.

5. Descriptions of the counties, grouped according to the regions to which they belong.

The lines between the agricultural regions, while sharply defined on the map, are necessarily more or less shadowy in reality, and it is in many cases a mere matter of choice or convenience whether a county is to be assigned to one or the other of the divisions. Still I have endeavored, in grouping the counties, to apply as consistently as possible the principles according to which the classification into agricultural regions was made.

Each description is preceded by statistics of area, population, cotton production, production of other leading crops, and estimates of the areas of each agricultural division. These latter figures have been obtained by map measurements, but they can make no claim to be more than close approximations. To this the inaccuracies of the state maps, and particularly the uncertainty as to the exact limits of the agricultural regions, have contributed.

To the description is appended, in every case where the schedules have been returned, an abstract of the answers to the schedule questions relating to the several soils and their cotton production, and to the direction, mode, and cost of shipment.

6. Abstracts of the answers to the schedule questions, covering the details of cultivation and preparation for market, diseases and insect enemies of the plant, labor, and system of farming are next given, arranged according to topics.

In collecting the data for this report I visited the following counties during the summer of 1880: Holmes, Gadsden, Leon, Wakulla, Jefferson, Madison, Suwannee, Columbia, Baker, Bradford, Nassau, Duval, Saint John's, Alachua, Marion, Sumter, and Orange. (*a*)

From the tables it will be seen that the counties above named produce the greater part of the cotton crop of the state. For this reason, and for lack of time, the remaining counties were not personally visited, and information concerning them has necessarily been derived from other sources, which are substantially the following:

The *schedule answers* returned from seventeen of the counties, abstracts of which, with due credit, are to be found in their proper places.

The publications of the *Bureau of Immigration*, under the present commissioner, Dr. French, and under his predecessor. In these pamphlets is condensed much valuable information concerning the soils, climate, and productions of the state, and free use has been made of both.

A View of West Florida, by Colonel John Lee Williams, published in 1827, and *An Account of the Territory of Florida*, by the same author, published in 1837. These books are models of clear, concise, and accurate description, and I acknowledge my great indebtedness to them throughout. With their aid I have been able to give a tolerably complete account of those parts of the state not personally examined. Some of the descriptions have been literally transcribed.

From the *judges of probate* of several counties I have obtained valuable notes on special subjects, and to Mr. Samuel Fairbanks, of the Bureau of Immigration; to Mr. J. V. Burke, of Marianna; to Mr. Jesse Wood, of Mount Pleasant; to Dr. E. B. Miles, of Fort Mason, and to many of the correspondents from whom reports were received, I am under great obligations, both for descriptions of parts of counties and for oft-repeated courtesies.

Very respectfully, your obedient servant,

EUGENE A. SMITH.

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a The geological results of this excursion were published in a paper "On the Geology of Florida" in the *American Journal of Science* for April, 1881.

TABULATED RESULTS OF THE ENUMERATION.

TABLE I.—AREA, POPULATION, AND COTTON PRODUCTION.

TABLE II.—PRODUCTION OF LEADING CROPS.

TABLE I.—AREA, POPULATION, AND COTTON PRODUCTION.

Counties.	Area in square miles.	POPULATION.						TILLED LANDS.			COTTON PRODUCTION.					Cotton, acreage per capita.	Cotton, acreage per square mile.
		Total.	Male.	Female.	White.	Colored.	Per square mile.	Acres.	Percentage of, in cotton.	Percentage of county area.	Acres.	Bales, 475 lbs.	Average per acre.				
													Bales.	Seed cotton.	Lint.		
														Lbs.	Lbs.		
OAK, HICKORY, AND PINE UPLAND REGION.																	
*Short-staple cotton.**																	
Jackson	1,000	14,372	7,132	7,240	5,637	8,735	14.37	84,738	31.77	13.20	26,920	6,144	0.23	324	108	1.87	26.92
Gadsden	540	12,169	5,926	6,243	4,114	8,055	22.54	65,304	29.81	18.90	19,464	4,696	0.24	345	115	1.60	36.04
Leon	900	19,662	9,570	10,092	2,822	16,840	21.85	104,857	41.00	18.20	42,988	9,562	0.22	318	106	2.19	47.76
Jefferson	560	16,065	7,929	8,136	3,397	12,668	28.69	104,350	35.94	29.10	37,500	10,368	0.28	399	133	2.33	66.96
Madison	850	14,798	7,224	7,574	5,609	9,189	17.41	83,962	34.52	15.40	28,982	7,064	0.24	348	116	1.96	34.10
Total	3,850	77,066	37,781	39,285	21,579	55,487	20.02	443,211	35.16	18.00	155,854	37,824	0.24	345	115	2.02	40.48
LONG-LEAF PINE REGION.																	
*Short-staple cotton.**																	
Escambia	720	12,156	5,945	6,211	6,854	5,302	16.88	1,298	1.93	0.30	25	10	0.40	570	190	.....	0.03
Santa Rosa	1,260	6,645	3,318	3,327	4,773	1,872	5.27	1,804	0.94	0.20	17	5	0.29	420	140	.....	0.01
Walton	1,360	4,201	2,072	2,129	3,685	516	3.09	9,373	15.33	1.10	1,437	382	0.27	378	126	0.34	1.06
Washington	1,330	4,089	2,089	2,000	3,171	918	3.07	12,063	15.56	1.40	1,877	602	0.32	456	152	0.46	1.41
Holmes	540	2,170	1,058	1,112	2,043	127	4.02	12,662	8.98	3.70	1,137	273	0.24	342	114	0.52	2.11
Calhoun	1,160	1,580	795	785	1,184	396	1.36	3,453	20.88	0.50	721	172	0.24	339	113	0.46	0.62
Liberty	800	1,362	681	681	814	548	1.70	3,630	20.22	0.70	734	197	0.27	381	127	0.54	0.92
Total short-staple cotton	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,948	1,641	0.28	393	131	.....	.....
Sea-island or long-staple cotton.†																	
Wakulla	580	2,723	1,325	1,398	1,563	1,160	4.69	13,678	16.90	3.70	2,311	561	0.24	340	85	0.85	3.98
Taylor	1,080	2,279	1,186	1,093	2,114	165	2.11	8,742	22.80	1.30	1,993	418	0.21	292	73	0.87	1.85
Suwannee	660	7,161	3,756	3,405	4,021	3,140	10.85	37,590	19.39	8.90	7,288	1,177	0.16	228	57	1.02	11.04
Hamilton	540	6,790	3,403	3,387	4,472	2,318	12.57	39,731	29.40	11.50	11,680	1,908	0.16	228	57	1.72	21.63
Columbia	860	9,589	4,855	4,734	4,820	4,769	11.15	45,759	28.72	8.30	13,142	1,992	0.15	212	53	1.37	15.28
Baker	500	2,303	1,210	1,093	1,660	643	4.61	4,898	22.60	1.50	1,107	215	0.19	272	68	0.48	2.21
Bradford	550	6,112	3,117	2,995	4,822	1,290	11.11	22,440	26.01	6.40	5,836	1,094	0.19	248	62	0.95	10.61
Nassau	640	6,635	3,486	3,149	3,075	3,560	10.37	4,554	4.28	1.10	195	53	0.27	386	95	0.03	0.30
Duval	900	19,431	9,719	9,712	8,580	10,851	21.59	5,959	0.96	1.00	57	23	0.40	564	141	.....	0.06
Saint John's	1,000	4,535	2,275	2,260	3,170	1,365	4.54	2,841	0.28	0.40	8	6	0.75	1,052	263	.....	0.01
Clay	640	2,838	1,462	1,376	2,265	573	4.43	4,069	11.21	1.00	456	96	0 21	296	74	0.16	0.71
Putnam	860	6,261	3,306	2,955	3,845	2,416	7.28	11,788	11.50	2.10	1,356	347	0.26	360	90	0.22	1.58
Alachua	1,260	16,462	8,490	7,972	6,446	10,016	13.07	49,731	29.45	6.20	14,646	2,519	0.17	240	60	0.89	11.62
Lafayette	940	2,441	1,298	1,143	2,268	173	2.60	7,962	5.93	1.30	472	107	0.23	316	79	0.19	0.50
Levy	940	5,767	3,081	2,686	3,732	2,035	6.14	15,645	23.43	2.60	3,665	1,251	0.34	476	119	0.64	3.90
Marion	1,680	13,046	6,589	6,466	4,741	8,305	7.77	50,160	26.53	4.70	13,305	2,426	0.18	256	64	1.02	7.92
Volusia	1,340	3,294	1,796	1,498	2,756	538	2.46	4,044	8.16	0.50	330	62	0.19	264	66	0.10	0.25
Orange	2,250	6,618	3,863	2,755	5,595	1,023	2.94	11,762	6.95	0.80	818	143	0.17	244	61	0.12	0.36
Sumter	1,380	4,686	2,495	2,191	3,501	1,185	3.40	14,550	17.37	1.60	2,527	419	0.17	232	58	0.54	1.83
Hernando	1,700	4,248	2,246	2,002	3,319	929	2.50	14,691	10.61	1.40	1,558	468	0.30	420	105	0.37	0.92
Hillsborough	1,300	5,814	2,987	2,827	4,899	915	4.47	11,261	4.94	1.40	556	150	0.27	376	94	0.10	0.43
Polk	2,060	3,181	1,663	1,518	3,033	148	1.54	8,688	5.54	0.70	481	95	0.20	276	69	0.15	0.23
Total for region	30,830	174,417	89,557	84,860	107,221	67,196	5.66	434,826	20.64	2.20	89,735	17,171	0.19	.....	.....	0.51	2.91
Total long-staple cotton	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	83,787	15,530	0.19	260	65	.....	.....
FITCH-PINE, TREELESS, AND ALLUVIAL REGION.																	
Sea-island or long-staple cotton.†																	
Franklin	690	1,791	907	884	1,199	592	2.60	521	.....	0.10	.....	.....	.....	.....	.....	.....	.....
Manatee	4,680	3,544	1,856	1,688	3,378	166	0.76	5,257	.....	0.20	.....	.....	.....	.....	.....	.....	.....
Monroe	2,600	10,940	5,371	5,569	7,659	3,281	4.21	1,705	.....	0.10	.....	.....	.....	.....	.....	.....	.....
Dade	7,200	257	153	104	190	67	0.04	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Brevard	4,390	1,478	819	659	1,379	99	0.34	1,952	0.31	0.10	6	2	0.33	464	116	.....	.....
Total	19,560	18,910	9,106	8,904	13,805	4,205	0.92	9,435	0.06	0.10	6	2	0.33	464	116	.....	.....
Total for State	54,240	269,493	136,444	133,049	142,605	126,888	4.97	887,472	27.67	2.60	245,595	54,997	0.22	*348	*116	0.91	4.53
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	†264	†66	.....	.....

* Bales = 475 pounds. Three pounds of seed-cotton to one pound of lint. † Bales = 330 pounds. Four pounds of seed-cotton to one pound of lint.

TABLE II.—ACREAGE AND PRODUCTION OF THE LEADING CROPS IN EACH AGRICULTURAL REGION.

Counties.	COTTON.		CORN.		OATS.		RICE.		SWEET POTATOES.		SUGAR-CANE.		
	Acres.	Bales.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Pounds.	Acres.	Bushels.	Acres.	Hogsheads of sugar.	Gallons of molasses.
OAK, HICKORY, AND PINE UPLAND REGION.													
Jackson	26,920	6,144	33,780	234,425	6,174	50,621	88	37,833	1,622	82,399	566	11	85,045
Gadsden	19,464	4,696	25,753	183,539	2,853	26,286	139	78,183	898	70,956	443	18	72,114
Leon	42,988	9,562	43,745	345,381	3,193	45,768	41	22,250	2,024	116,383	844	23	71,830
Jefferson	37,500	10,368	39,059	350,148	3,949	48,357	22	11,129	987	89,287	537	63	62,527
Madison	28,982	7,054	33,493	285,281	5,894	64,130	77	23,867	889	86,815	573	66	79,741
Total	155,854	37,824	175,830	1,398,774	22,063	235,162	367	172,762	6,420	445,840	2,963	181	375,257
LONG-LEAF PINE REGION.													
Escambia	25	10	602	6,423	132	1,541	68	24,820	164	15,495	12	.....	1,167
Santa Rosa	17	5	1,135	9,850	60	435	169	98,823	158	15,298	43	2	2,908
Walton	1,437	382	6,025	50,275	1,091	9,703	120	84,289	804	29,533	153	20	19,828
Washington	1,877	602	5,809	47,167	565	6,574	84	66,735	325	32,070	131	.....	31,556
Holmes	1,137	273	4,273	31,479	761	5,780	120	79,740	135	21,663	74	2	12,270
Calhoun	721	172	1,643	17,303	391	4,340	75	28,120	173	17,820	52	2	11,810
Liberty	734	197	2,202	16,285	621	5,756	71	24,825	128	12,034	59	.....	10,891
Wakulla	2,311	561	6,871	50,140	554	6,207	37	26,000	134	19,991	108	.....	24,559
Taylor	1,993	418	5,224	40,051	835	6,940	40	16,860	224	22,959	124	6	19,292
Suwannee	7,288	1,177	12,410	99,855	2,132	18,634	154	56,206	484	40,592	238	121	26,622
Hamilton	11,680	1,908	14,991	110,503	2,570	21,413	225	126,464	379	33,402	222	76	26,854
Columbia	13,142	1,992	18,685	172,795	4,616	38,389	317	132,974	687	68,080	297	111	27,074
Baker	1,107	215	2,388	22,838	484	2,584	59	30,785	208	16,726	48	13	4,842
Bradford	5,836	1,094	9,511	91,305	2,119	17,829	143	65,212	388	46,117	260	40	35,572
Nassau	195	53	2,559	23,449	294	2,535	14	8,564	282	21,190	64	6	9,650
Duval	57	23	1,939	17,030	46	617	92	43,885	476	30,921	121	32	13,221
Saint John's	8	6	1,282	13,997	52	481	16	4,410	273	29,259	149	37	13,930
Clay	456	96	1,885	16,850	214	2,509	45	28,209	146	14,505	74	51	8,320
Putnam	1,356	347	2,675	29,019	566	5,757	12	5,803	467	40,413	109	38	10,781
Alachua	14,646	2,519	19,246	221,869	1,906	10,787	73	27,740	845	90,200	361	59	42,939
Lafayette	472	107	3,420	38,420	351	2,969	.....	.....	103	11,854	56	14	6,542
Levy	3,665	1,251	7,250	73,899	2,096	19,782	.....	.....	365	47,357	292	4	50,426
Marion	13,305	2,426	16,641	186,917	1,793	15,629	71	19,632	1,803	96,322	274	75	33,802
Volusia	330	62	1,250	12,672	40	375	2	600	508	31,394	57	19	5,796
Orange	818	143	2,763	26,727	140	1,412	8	7,040	663	65,198	202	64	19,428
Sumter	2,527	419	6,909	68,972	627	5,572	.....	.....	398	34,171	237	38	34,790
Hernando	1,558	468	10,883	146,008	1,371	15,969	88	61,547	619	120,448	383	61	64,171
Hillsborough	556	150	4,968	48,719	98	775	28	13,279	583	68,410	238	36	35,366
Polk	481	95	5,593	52,073	269	1,556	20	14,000	484	51,820	154	46	8,694
Total	89,735	17,171	181,032	1,746,890	25,894	232,850	2,146	1,091 502	11,906	1,149,268	4,592	973	612,661
CUBAN PINE, TREELESS, AND ALLUVIAL REGION.													
Franklin	.....	.....	145	1,761	.....	.....	.....	.....	197	15,040	81	.....	13,250
Manatee	.....	.....	2,668	19,978	.....	.....	22	14,539	436	53,515	124	85	5,325
Monroe	.....	.....	64	645	.....	.....	3	1,200	48	3,445	26	10	2,258
Dade	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Brevard	6	2	555	6,186	5	100	13	14,674	160	20,505	152	24	21,117
Total	6	2	3,432	28,570	5	100	38	30,413	841	92,505	383	119	41,950
Total for State	245,595	54,997	360,294	3,174,234	47,962	468,112	2,551	1,294,677	19,167	1,687,613	7,938	1,273	1,029,868

PART I.

PHYSICO-GEOGRAPHICAL AND AGRICULTURAL FEATURES OF THE STATE OF FLORIDA.

AGRICULTURAL MAP OF FLORIDA

COMPILED FROM

MS. NOTES AND OTHER SOURCES

BY

EUGENE A. SMITH, PH.D.

SPECIAL AGENT

1880.

LEGEND

- Everglades and unexplored
- Swamps
- Sea Marshes
- Live Oak Hammocks
- Savannahs
- Prairies
- Pine Flats (Pitch Pine)

Pitch or Cuban Pine Treeless and Alluvial Region

- Pine Flats (Long Leaf Pine)
- Rolling Pine Lands
- Hammocks

Long Leaf Pine Region

- Oak, Hickory and Pine Uplands.

Upland Region

Scale

30 0 30 60 90 MILES

GULF OF MEXICO

ATLANTIC OCEAN

ESCAMBIA SANTA ROSA WALTON HOLMES JACKSON WASHINGTON CALHOUN GADSDEN LIBERTY FRANKLIN WAKULLA LEON JEFFERSON MADISON TAYLOR HAMILTON SUWANNEE COLUMBIA BAKER BRADFORD UNION ALACHUA NASSAU DUVAL ST JOHNS MARION PUTNAM FLAGLER VOLUSIA HERNANDO SUMTER ORANGE POLK BREVARD HILLSBOROUGH MANATEE LAKE OKEECHOBEE MONROE DADE THE FLORIDA KEYS

GENERAL FEATURES OF THE STATE OF FLORIDA.

PHYSICAL GEOGRAPHY.

Florida, the southernmost state of the United States, lies between the parallels of 24° 30′ and 31° north latitude and the eightieth and eighty-eighth meridians west from Greenwich. Its total gross area, as determined by the latest measurements, is 58,680 square miles. The greater part of this area (about 35,000 square miles) is a peninsula, about 350 miles long, with an average width of 100 miles, separating the waters of the Atlantic ocean from those of the Gulf of Mexico.

The rest of the state, known as eastern (from the Atlantic to the Suwannee river), middle (from the Suwannee to the Apalachicola river), and western Florida (from the Apalachicola to Perdido river), nearly 24,000 square miles, is embraced in a strip 320 miles long and about 75 miles wide, lying immediately south of the lines of Georgia and Alabama.

Roughly speaking, about one-half the area of eastern, middle, and western Florida and from one-fourth to one-third of the peninsula are uplands of various kinds; the rest lowlands, including the level flatlands near the coasts, the Everglades, savannas, etc.

CLIMATE.—The climate is greatly influenced by the Atlantic ocean and the Gulf of Mexico. Extremes of heat and cold are rare, the temperature in winter seldom falling much below 32°, and in summer seldom rising above 90°. The average temperature for the summer is 78°, for the winter 60°. The daily ocean breezes temper the heat of summer, the breeze from the Atlantic lasting during the day, while the Gulf breeze sets in about nightfall.

From the Smithsonian records from 1844 to 1867, kept by Dr. A. S. Baldwin, the following mean temperatures for each month of the year at Jacksonville have been taken:

	Deg.		*Deg.*		*Deg.*
January	55	May	76	September	78
February	58	June	80	October	70
March	64	July	82	November	62
April	70	August	82	December	52

The hottest months are June, July, and August, and the coldest December, January, and February, the uniformity being shown by the small difference (30°) between the coldest and the hottest months.

The mean temperature at Saint Augustine, derived from twenty years' observations, is: For spring, 68.54°; for summer, 80.27°; for autumn, 71.73°; for winter, 58.08°.

For Tampa the observations of twenty-five years give the following mean temperatures: For spring, 72.06°; for summer, 80.2°; for autumn, 73.08°; for winter, 62.85°.

The mean temperature at Key West, calculated from fourteen years' observations, is: For spring, 75.79°; for summer, 82.51°; for autumn, 78.23°; for winter, 69.58°.

The average rainfall at Jacksonville (mean of sixteen years) is 50.29 inches, the largest quantity falling in August and September, the least in November. The frequent showers in early spring, during the planting season, are highly favorable to the germination and growth of the seeds planted. Droughts and excessive rains over any large extent of territory are rare:

DRAINAGE.—*Rivers.*—The principal streams of Florida are the Apalachicola, the Suwannee, the Saint Mary's, Saint John's, Kissimee, and Indian rivers, the last named being merely an arm of the sea running parallel with the eastern coast. The Saint John's and the Kissimee in some parts of their courses consist of a chain of lakes connected by the water-courses, the former, rising in the region surrounding the Everglades, flowing northward, and the latter flowing southward toward the Everglades, the two in part of their courses flowing approximately parallel to each other, but in opposite directions, and at no great distance (20 to 30 miles) apart.

According to statements based upon surveys recently made, the waters of the Everglades are elevated 22 or 23 feet above the sea, and the level of lake Harney, on the upper Saint John's, is 9 feet above tide. These figures, if correct, would make the waters of the Kissimee some 14 feet above those of the Saint John's.

The Kissimee, with its lakes, affords the channel by which the elevated ridge of the peninsula from Orange county southward is drained into the Everglades, the Ocklawaha and its lakes draining the same elevated country from Orange county northward. A characteristic feature of the drainage of Florida is the sinking of the streams into subterranean passages and their reappearance as "big springs". The natural bridges thus formed are sometimes narrow and sometimes are several miles across.

Lakes.—In the number and variety of its lakes Florida is distinguished among the states. These lakes vary in size from mere ponds to vast sheets of water like lake Okeechobee, which has an area of more than 500 square miles. In some instances they are apparently fed from underground sources and form the headwaters of streams; in other cases the streams flow through them, which thus appear as mere local widenings of the channels; and in still other cases lakes which receive the drainage of large areas by means of rivers have no visible outlet, the waters being removed by evaporation or by subterranean outlets. The waters of lake Okeechobee are apparently generally connected with those of the Everglades, which are carried off to the sea by a number of channels.

It is impossible to form an estimate of the number of lakes, large and small, with which the scenery of Florida is diversified, for in some parts of the state one may travel for days at a time without being out of sight of these sheets of water. In those sections where the lakes are most abundant they receive the drainage over large areas, and the water-courses are subterranean.

Everglades.—This remarkable feature of Florida has been described as a shallow lake of vast extent, filled with aquatic grasses and other similar vegetation, giving it the appearance of a vast wet meadow. This wet meadow, or shallow lake, is dotted with islands of from one acre to a hundred acres in extent, which rise a few feet above the level of the waters, and are covered with a growth of live and water oaks, cabbage palmetto, and other timber.

The Everglades occupy a depression in the limestone of the country, and are surrounded by a rocky rim, skirted (toward the glades) by a belt of rather low prairie or savanna land.

The headwaters of most of the streams of southern Florida are found in the Everglades, and lake Okeechobee, which seems to be merely an open lagoon, receives the waters of at least one large stream, the Kissimee river. The waters of this lake appear to diffuse through the Everglades, whence they are drained off east, south, and southwest through the various streams mentioned below. The level of the waters is given at 22 to 23½ feet above the sea. Further details will be found below in the general account of the agricultural features and under Dade county.

ELEVATION ABOVE THE SEA.—The ancient maps and accounts of travelers represent the interior of Florida as mountainous; later, the prevailing belief represented the state as comparatively low and flat throughout, while the truth lies between these two extremes.

The upper half of what are known as middle and western Florida consists of uplands, which are entirely similar to the corresponding uplands of Georgia and Alabama. Some parts of these uplands are broken or hilly, and the elevation above the sea cannot be far from 300 feet. Toward the Gulf and the Atlantic there is a gradual slope, and within 10 miles of the coast the elevation is scarcely more than 10 feet above tide.

From the Georgia line, in the vicinity of Okeefenokee swamp, southward down the peninsula, there is an elevated belt of land, known, in part of its course at least, as Trail ridge. This elevated land is known to extend as far south as Polk county, and its height above the sea is between 200 and 300 feet. Between this main ridge and the Gulf there is another ridge, known as the Sand hills, 120 feet and more in elevation.

In Hernando county are high hummock lands of considerable elevation, and Mount Lee, near the head of Homosassa river, is said to be 214 feet high.

The lower part of the state, from Polk county southward, is generally low, comparatively level, and with an elevation probably not greater than 30 or 40 feet. The immediate coast in some localities has an elevation of 15 feet, which is looked upon by some as evidence of upheaval in recent times, and by others as the result of the action of the waves alone.

The altitudes as determined by railroad surveys are difficult to obtain, having been in most cases lost in the transfers of the properties. The tables on page 9 were furnished by the kindness of Major P. W. O. Koerner, engineer:

I.—TRANSIT RAILROAD

Names.	Distances from Fernandina.	Altitude above low tide in the Atlantic.	Remarks.
	Miles.	*Feet.*	
Fernandina	*0	0	Back tide-water.
Boggy river	*20		
Callahan	27	30	
Dutton	36	45	
Baldwin	47	47	
Maxville	56	57	Foot of Trail ridge.
Summit of Trail ridge	61	210	
Western foot of Trail ridge	62½	180	
Lawtey	66	140	
Starke	73	150	
Santa Fé (lake outlet)	79	137	
Waldo	84	150	
Hatchet creek	91	(about) 100	
Gainesville (court-house)	95	128	
Arredondo	100 (†)	70	
Archer	107	70	
Sand Hills (summit)		120	
Bronson	127	27	
Otter creek (Gulf hummock)	134	19	
Rosewood	144	10	
Cedar Keys	154	0	

*27 feet highest elevation between these points.

II.—PENINSULA RAILROAD.

	Names.	Elevation above low tide in the Atlantic.	Remarks.
		Feet.	
Topographical features near line of road.	Santa Fé lake	137	
	Pithlachooke lake	85	
	Payne's prairie	68	Rim of prairie about 100 feet higher.
Stations	Lochloosa lake and Orange lake	52	
	Silver spring	39	
	Hawthorne	150	
	Lochloosa	60	
	Ocala (court-house square)	100	
	Ridge one mile south of Ocala (hummock)	100	

Average elevation of the country between Ocala and Orange lake, 80 feet.

III.—FLORIDA SOUTHERN RAILROAD.

Elevations of stations on Florida Southern railway

[Obtained from Engineer Miller.]

	Feet.
Saint John's river at Palatka	0
Palatka	15
Francis	70
MacWilliams	80
Blue pond	110
Johnson	100
McMeekin	105
Hawthorne	136
Scott place	86
Junction	90
Prairie creek	53
Alachua	88
Gainesville	168

GEOLOGY.

1.—STRUCTURAL AND STRATIGRAPHICAL.—The remark of one of the leading geologists of America that Florida has been universally misunderstood is true as regards both the topography and the geological structure of the state. To these erroneous impressions several circumstances have largely contributed. The photographic and other pictures of Florida have generally been selected, with a view of presenting the state in its semi-tropical aspects, and since Florida in the interior and in the highlands exhibits nothing characteristic by which it is distinguishable from the adjacent parts of contiguous states the most widely circulated views are those of scenes along the banks of the rivers or of the numerous and beautiful lakes of the state. The lack of railroads has restricted tourists and other visitors generally to a few great highways of travel, such as the Saint John's, Ocklawaha, and Indian rivers, and for this reason the geological observations hitherto published have been made usually either along the coasts or along the banks of the rivers mentioned.

In view of the prevailing misconceptions concerning Florida, it has been thought desirable to give here a summary as complete as possible of the published accounts of the geology of the state.

OBSERVATIONS MADE PREVIOUS TO 1880.—As early as 1776 Bartram, who traveled in the peninsula as far south as the present Alachua county, speaks of the limestone outcropping through the sands in many places. He also mentions limestone as forming the basins of some lakes and of large boiling springs, but makes no statement regarding the geological age of the rock.

Colonel John Lee Williams, in his *View of West Florida*, published in 1827, and later in his *Territory of Florida*, published in 1837, gives accurate accounts of the topography and rock structure of various parts of the state. The prevalence of a limestone as underlying rock throughout the entire state is there frequently mentioned, and many of its characteristic varieties are carefully described, though no attempt is made to fix its geological position.

Later, in 1838, Major Whiting mentions the fact that the rocks found *in situ* in Florida are all calcareous, and speaks of a flinty limestone in the interior, and of its connection with the many "surth-holes" and big springs.

In 1846 Lieutenant Allen makes mention of a limestone occurring at Tampa and at various points in the interior, where it forms the sides and basins of many of the lakes. He makes a careful distinction between this and a much more recent limestone occurring along the coast.

In the same year T. A. Conrad collected and described fossils from this older Tampa limestone, and settled definitely its age as Upper Eocene. He also speaks of a limestone as prevailing in the interior, which he thinks will prove to be of the same age.

Professor J. W. Bailey discovered near Tampa, and between Gainesville and Palatka, infusorial strata, which, together with their fossil contents, were described in the *American Journal of Science* and elsewhere. These deposits he considered to be Eocene, from their association with rocks containing shells of that age.

In 1850 Professor Tuomey, of the University of Alabama, visited the Gulf coast of Florida. He confirmed the statement of Conrad respecting the age of the Tampa limestone, and said that the same rock extended probably as far south as Charlotte harbor.

In 1854 W. J. Burnett corrects the prevailing opinion relative to the flatness of Florida by showing from altitudes obtained by surveys that there are points in the peninsula 237 feet above the Atlantic, and that 15 or 20 miles west of the Saint John's river there are elevations of 150 to 200 feet. He considered the peninsula to be of comparatively recent origin, except an elevated ridge extending from Georgia southward to a line joining cape Canaveral with Tampa; but he does not express any more definite opinion as to the age of this ridge.

Professors L. Agassiz and John Le Conte, as results of their explorations of the Florida coast in 1851, conclude that the greater part of the peninsula is of comparatively recent origin, and the latter author, in 1857, published his theory relating to the agency of the Gulf Stream in forming the submarine banks upon which the corals could grow, which were so instrumental in extending the peninsula southward. Professor Le Conte considered as problematical the existence of Tertiary limestone at Tampa, as established by Conrad and Tuomey, but, assuming that the limestone does actually occur there, he thinks it probable that all of Florida south of the line from Tampa to Saint Augustine was formed by successive additions to the land in the manner described by him, and that this extension took place in comparatively recent times.

In 1857 Professor John Le Conte procured from Silver Spring, near Ocala, some fossils which were subsequently recognized to be of Eocene age, as is recorded in the *American Journal of Science* for January, 1861, pages 1–12.

Since the researches of Professors Agassiz and Le Conte were published, the older and correct observations of Conrad, Tuomey, Bailey, and others appear to have been completely overlooked, and upon the latest geological map of the United States Florida is represented as Quaternary throughout.

OBSERVATIONS MADE IN 1880 (*a*).—While collecting material for the present report during the summer of 1880 I had the opportunity of making observations upon the geological structure of Florida from Jackson county, on the west, to Orlando, in Orange county, and the country rock everywhere between these two limits was found to be the Vicksburg or Upper Eocene limestone, with the exception of the recent or post-Tertiary coral limestone formations near the coasts and a limestone of Miocene age at Rock Spring, near Apopka city, east of the lake of the same name, in Orange county. (*b*)

West of Jackson county to the Perdido river the country was not personally visited, but from the position of the Vicksburg limestone in the adjoining counties of Alabama it seems almost certain that the whole of west Florida, with the probable exception of a strip near the Gulf coast, is underlaid by the same rock.

On the Gulf shore, between the mouth of the Perdido river and Apalachee bay, the immediate coast is sandy and the underlying rocks are hidden from view; but a few miles in the interior the presence of fresh-water mollusks in the streams, and the vegetation along their banks, give certain evidence of the existence of calcareous rocks below. From Appalachee bay to the mouth of the Suwannee river the coast is formed of limestone, which extends out to sea for several miles in shoal water.

South of the Suwannee the rugged coast is still formed of this rock, and is bordered with rocky islands or keys. At about the twenty-seventh parallel the calcareous rock above mentioned begins to be covered with the structures of the coral polyp, and down this coast and around on the eastern shore as far as the Soldier's key the coral formation is prominent on all the Florida keys (Williams).

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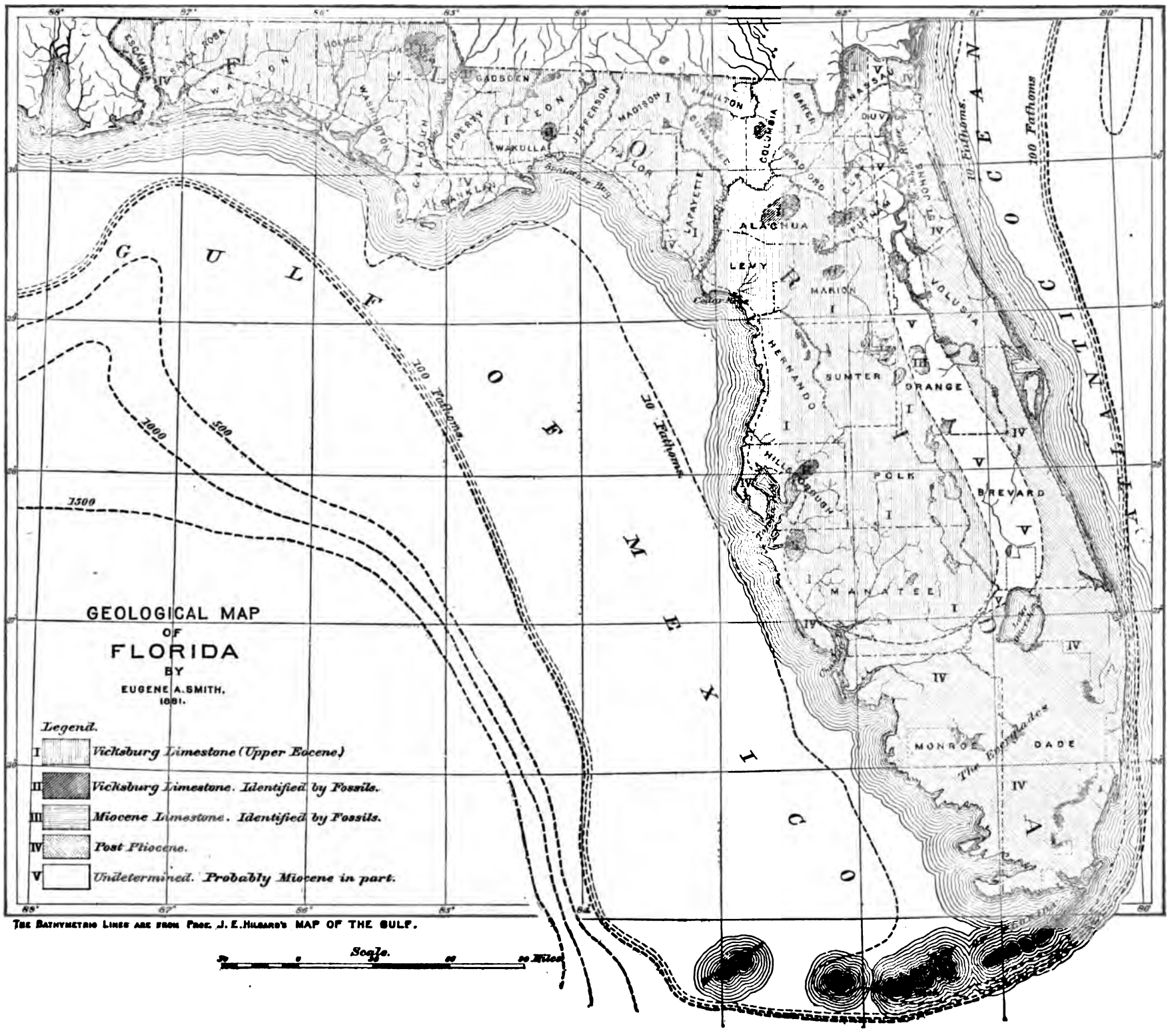
a See "On the Geology of Florida", by Eugene A. Smith, *American Journal of Science*, April, 1881.

b Though not yet observed, it is quite probable that limestone of this age will be found in other localities, occupying a similar position between the Eocene limestone on the west and the more recent post-Pliocene deposits near the Atlantic coast.



The Bathymetric Lines are from Prof. J. E. Hilgard's MAP OF THE GULF.

the rock above described, which he believes to be the base or substratum of the peninsula and of the keys. Colonel Williams here makes a clear distinction between the limestone which forms the Gulf coast, and, as he believes, also the base of the peninsula and keys, and the newer coral formations which rest directly upon it below the twenty-seventh parallel.

4. After the Miocene (or possibly after the Pliocene) period there was again an elevation (*a*) of Florida, as is shown by the presence of a Miocene limestone on the eastern slope of the peninsula, some distance (not less than 30 feet) above present sea-level. The absence along the Gulf coasts of Miocene and later Tertiary deposits, either of marine (limestone) or of brackish- or fresh-water (Grand Gulf) origin, has already been accounted for above. During this period, between the end of the Vicksburg and the close of the Tertiary, the Florida peninsula, with at least twice its present size, was subjected to subaerial erosion, which marked its surface with hills and valleys. The distribution of the high hummocks along the present peninsula is explained below as dependent upon the position of the elevated points of this old Tertiary peninsula, and the greater prevalence of high hummocks on the western side of the water-shed between the Gulf and the Atlantic, and the occurrence of coast hummocks (Gulf hummocks) exclusively on the western or Gulf coast, seem to be strictly in accordance with the preceding conclusions.

Professor J. E. Hilgard, in an article on the "Basin of the Gulf of Mexico", published in the *American Journal of Science*, III, vol. 21, page 291, writes as follows: "The 100-fathom curve represents very closely the general continental line; the *massiv* of the peninsulas of Florida and Yucatan have more than twice their present apparent width. * * * * Very steep slopes lead from this submerged plateau to an area of 55,000 square miles * * * * at the great depth of over 12,000 feet. There are three ranges on the Florida and Yucatan slopes, extending in the aggregate to more than 600 miles, along which the descent, between 500 and 1,500 fathoms, or 6,000 feet, is within a breadth of from 6 to 15 miles. No such steep slopes and correspondingly elevated plateaus appear to exist on the unsubmerged surface of the earth. The suggestion occurs that while the latter have suffered atmospheric erosion, the submerged surfaces have not sensibly changed from the positions determined by the mechanical shaping of the earth's crust." (*b*)

5. We have evidence in the distribution of the beds of the Champlain period (stratified drift or orange sand) that Florida and parts of adjacent states were during this time submerged sufficiently to allow the deposition over them of a mass of pebbles, sand, and clay, varying in thickness from a few feet to 200. The conditions under which these beds were deposited have been ably discussed by E. W. Hilgard in the *American Journal of Science*, and in his Mississippi and Louisiana reports. Of these conditions I shall speak of one only. From the peculiar mode of stratification of most of these beds it is concluded, with reason, that they were sediments from rapidly-flowing, ever-varying currents. In the northern part of the state the beds of red and yellow loam lie directly upon the stratified drift. These beds of loam are devoid of stratified structure as well as of fossils, and were probably deposited from slowly-running or nearly stagnant waters. The direct superposition of the loam upon the stratified drift throughout Florida, Alabama, and the greater part of Mississippi and Louisiana, and the fact that there is, with the exception presently to be noted, rarely if ever any sharp line of demarkation between the two—the upper beds of the drift passing by imperceptible gradations into the loam—point strongly to a community of origin, and appear to indicate that the loam is the last of the sediments made by the floods of the drift. Along the Mississippi river the two are separated by the Port Hudson and Löss deposits, both having more or less local characters, the Löss being distinctly a river-bank and the Port Hudson a river or gulf swamp deposit. We can imagine that after the great rush of waters which deposited most of the pebbles and other coarse materials of our drift there followed, over the larger part at least of the Gulf states, a gradual checking of the currents, and consequent deposition of the finer yellow loam, while along the axis of the Mississippi, where, as Hilgard has shown, the extremes of oscillation were experienced, this gradual change from swiftly-flowing to nearly stagnant waters might have been interrupted by such subordinated and local oscillations as would have caused the formation of deposits like the Port Hudson and the Löss.

6. Following the submergence during the Champlain period was a re-elevation, which brought up the peninsula with approximately its present configuration. (*c*)

Evidences on this point are to be found in the post-Pliocene formations described by Conrad, Tuomey, and others as bordering, more or less uniformly, the eastern, southern, and western shores, and forming the keys.

7. In the height of these post-Pliocene deposits above the present sea-level Conrad and Tuomey see proofs of the elevation of the peninsula and keys (10 or 15 feet) in still more recent times, while, on the other hand, Professors Agassiz and Le Conte give a different explanation. To quote the words of the latter author: "Neither the mainland nor the keys are anywhere higher than may be accounted for by the action of the waves, viz: from 10 to 15 feet."

8. Since the elevation of Florida to its present position atmospheric agencies have been at work scouring its surface and producing those inequalities which constitute its present scenery. In some places the removal by these agencies of the later Champlain beds has exposed the elevated points of the old limestone peninsula, or special lines of drainage have cut down to the general level of this rock, which, in either case, by its action upon the soil, has produced hummocks. The circulation of the atmospheric waters below the surface has caused the formation of caverns and underground channels in the limestone, and has thus given rise to many of the characteristic features of the Florida landscape, as sinks, ponds, lakes, "blue springs," etc.

9. In view of the absence of marine formations of the Middle and Upper Tertiary age along the Gulf coasts of Mississippi, Louisiana, and Texas, and to account for the formation of the beds of the Grand Gulf group, without remains of marine life, which overlie the Eocene of those coasts, Professor E. W. Hilgard has been brought to the conclusion that during a part or the whole of the interval between the Vicksburg and Champlain periods the Gulf was by some means partially or wholly isolated from the Atlantic, and thus converted into a fresh- or brackish-water basin, and he also further suggested that this was brought about by a land connection between Florida and Yucatan.

The facts lately brought to light by Dr. Loughridge and myself, taken in connection with the soundings in the Gulf made under the auspices of the coast survey, point to a more probable explanation of the means by which the partial freshening of the waters of the Gulf was effected.

Professor Hilgard writes as follows:

"The inference is irresistible that the upward movement of the Tertiary period continued up to the end of the Glacial epoch. * * * It is clear, also, that even a minimum elevation of 450 feet, so far proven, would convert the Gulf border to the edge of the 100-fathom

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a On this point compare foot-note under 3, above.

b It is proper to state that the article of Professor Hilgard on the Gulf basin and my own on the geology of Florida appeared simultaneously in the *American Journal of Science*, so that the conclusions in each were independently reached.

c We can only speculate as to when and how the change from the broad peninsula of the Middle and later Tertiary periods to the present narrow form took place. Two possibilities suggest themselves, viz: 1. At the beginning of the Champlain period a more profound depression of the western as compared with the eastern half of the broad Tertiary peninsula; or, 2. At the end of the period of submergence the shifting of the main axis of elevation eastward would have brought about this result.

line into a region of shallows, whose waters would be kept perceptibly freshened by the continental drainage, especially in the axis of the Mississippi valley, even in the present condition of the straits of Yucatan and Florida. If, however, we suppose the bottom of the latter to have participated in the elevation to a greater or less extent, sensibly lessening the oceanic circulation, the freshening of the border waters may readily be supposed to have been such as to render very precarious the existence of either a marine or a fresh-water fauna, thus accounting for the remarkable dearth of fossil forms in the Grand Gulf strata." (*a*)

The facts with regard to the distribution of the rocks of Florida are presented on the accompanying map. (The bathymetric lines are taken from Professor J. E. Hilgard's map.

Those points where the existence of the Vicksburg limestone has been determined beyond doubt by fossils collected and identified are indicated upon the map by appropriate marking, explained in the legend. This formation was first recognized, at Tampa and near the mouth of the Manatee river, by Conrad; between Gainesville and Palatka, by Professor J. W. Bailey; at Silver Spring, by Professor John Le Conte; and at the other localities marked, by myself. The locality of the Miocene limestone was first observed by myself, and the post-Pliocene age of the coasts and keys has been determined at many points by Conrad, Tuomey, Agassiz, Le Conte, and others.

Between the post-Pliocene on the eastern coast and the Eocene of the interior a space is left blank, as *undetermined*, except in one place, Rock Spring, where the Miocene limestone was noticed. In this area other occurrences of Miocene beds will probably be found.

2.—PHYSIOGRAPHICAL GEOLOGY.—Since the surface configuration, soils, and other features of Florida are in great part dependent upon the mutual relations of the two principal formations above named, viz, the Upper Eocene or Vicksburg limestone, which forms the substratum through most of the state, and the stratified drift and loam, which form the surface materials, it will be well to give more in detail the chief character of each.

The limestone.—This rock, which has been shown to be of Upper Eocene or Vicksburg age by the fossils collected at widely distant localities, presents the following principal varieties:

1st. A white pulverulent mass of carbonate of lime, without recognizable fossils, except a few silicified tubes of as yet undetermined affinities. This natural marl, mingling with the sands near the coast, forms the well-known "Gulf hummocks". In these the soil appears to a casual observer to be composed almost entirely of white sand, and the vigorous growth supported by it seems at first unaccountable.

The composition of this substance is shown by the following analysis:

Pulverulent limestone from Wakulla county.

Insoluble matter	35.555	39.011
Silica soluble in soda carbonate	3.456	
Potash		0.372
Soda		0.338
Lime		30.986
Magnesia		0.424
Brown oxide of manganese		0.134
Peroxide of iron		0.584
Alumina		1.196
Phosphoric acid		0.014
Sulphuric acid		0.331
Carbonic acid		24.253
Water and inorganic matter		3.074
Total		100.667

2d. An earthy, very slightly fossiliferous, much disintegrated limestone, which appears to form always the substratum of the "high hummocks" of the interior. This rock is of a yellowish to white color, somewhat granular, and in disintegrating breaks up into small, rounded, pebbly masses. Disseminated through the soil, it imparts to it a great degree of fertility, as is shown by its heavy growth of live oak, water oak, Spanish oak, and other hard woods, and also by the large crops produced upon the land when cleared and cultivated. It seems probable that this variety may be found as substratum of part of the "Gulf hummocks" also.

3d. A porous, friable mass, made up almost entirely of the shells of *Orbitoides Mantelli*, *O. floridana*, and similar species, with here and there shells of other genera, all characteristic of the Upper Eocene or Vicksburg stage of the Tertiary.

4th. A light-colored, tolerably soft, porous rock, which has been quarried for building purposes, but which, on analysis, proves to be much more valuable as a source of phosphoric acid. This material was first brought into notice by Dr. C. A. Simmons, of Hawthorne, Florida, who forwarded specimens to Dr. George W. Hawes.

An analysis (see page 14), carried out by the direction of Dr. Hawes, revealed the true character of the rock, which contains in some cases as much as 16 per cent. of phosphoric acid.

a "Later Tertiary of the Gulf of Mexico", by Eugene W. Hilgard, *American Journal of Science*, III, vol. xxii, p. 64.

Phosphatic rock, Hawthorne, Alachua county.

Silica	46.83
Alumina	19.61
Ferric oxide	1.64
Lime	2.75
Magnesia	0.27
Phosphoric acid	16.02
Water	14.28
Total	101.40

The mean of two other analyses of specimens from the same locality is given below in the table of analyses.

As yet, the amount of this material available is not known, but specimens have been received from localities a mile apart.

This variety of the rock and the two preceding, when freshly quarried, are quite soft and easily cut with a saw, and on this account they are almost universally used where they occur (in Mississippi, Alabama, and Florida) in the construction of chimneys. For this purpose the rock is cut into blocks of suitable size, which harden upon exposure to the atmosphere, and where somewhat protected the chimneys thus made are durable. Objection to it as building material is its porosity, for it absorbs water readily, and this in freezing causes the stone to crumble. Notwithstanding this objection, the oldest chimneys throughout the region of this limestone are constructed of it, and they show, as a general thing, no greater evidences of decay than do the brick chimneys.

5th. A highly fossiliferous variety, composed chiefly of shells of Orbitoides, is often quite hard, and produces very little effect upon the soil, for it often outcrops through the most barren sands of the pine woods.

6th. Another hard, compact variety has very few fossils, and is impregnated with silica, which often takes the form of nodules of flint or hornstone. Major Whiting, above quoted, speaks of bowlders of silica occurring in the limestone from which the Indians manufactured their flints; and Professor Bailey found between Gainesville and Palatka nodules of flint, from which he prepared thin sections for the microscope, and in these he discovered many forms of infusoria. The flint is quite prevalent also along the Gulf coast below the mouth of Suwannee river.

7th. Lastly, Colonel Williams notes the occurrence of crystalline limestone in Hamilton county, near the Suwannee river, and on the Econfina, in Washington county.

The stratified drift and loam.—These two formations, while quite distinct in portions of Mississippi, where they were first accurately described, are in Florida so closely associated as to justify their treatment together. The thickness of these beds is quite variable (from a few feet up to at least 100), and, as they have been deposited upon an eroded surface of the underlying limestone, great variations in the thickness may be noticed in comparatively limited areas. The most abundant material of the drift is a siliceous sand, often colored by hydrated ferric oxide. The depth of color decreases, as a rule, southward, and on the peninsula proper white or very light-colored sands greatly predominate. In the upper counties, adjoining Alabama and Georgia, various shades of yellow and red are characteristic.

Next in importance are beds of rounded, water-worn pebbles of quartz, rarely as large as a walnut, and usually much smaller. These pebbles are more numerous and larger northward and along the lines of certain water-courses, such as the Apalachicola. Upon the peninsula they have been observed only in a few instances, and then are small in size (no larger than peas) and comparatively few in number. Beds of clay are of local occurrence, and are not abundant.

The upper beds of the stratified drift are frequently seen to grade off almost imperceptibly into a reddish or yellowish clay loam, having often a thickness of 15 to 20 feet, and showing no traces of stratification or of fossils. This loam forms the subsoils and frequently the soils of the oak uplands, and is confined to the northern part of the state, thinning out and disappearing within 10 or 15 miles of the coast. The principal occurrence of the loam is in the contiguous parts of middle and western Florida, on both sides of the Apalachicola river.

While a distinguishing feature of the loam is the absence of all traces of stratification, the drift is equally characterized by the great irregularity of its lines of stratification. Rarely can the same stratum be traced continuously for any great distance, and the materials change greatly within comparatively limited areas.

Topography as influenced by the quality and thickness of the superficial beds overlying the limestone.—The several materials of the drift and loam offer varying degrees of resistance to denudation. When clays and loams predominate, rain-water penetrates very slightly, being mostly shed from the surface, and, collecting into rills, rivulets, and torrents, it produces that endless variety of topography characteristic of clayey lands everywhere. For this reason the oak-upland region of Florida shows a greater variety of scenery than the rest of the state. On the other hand, where sands predominate, as, for instance, southward upon the peninsula, the rains are quickly absorbed and dispersed below the surface, thus producing very little erosion, and causing the formation of those gentle undulations which characterize the sandy lands.

Throughout Florida the underlying limestone has been dissolved away in the most irregular manner by the atmospheric agencies, and is everywhere traversed by caverns, the outcropping rock presenting the most fantastic

shapes. The sinking in of the roofs of such caverns causes depressions of greater or less extent, which assume a character dependent in great measure upon the nature and thickness of the superficial beds; for where these are of considerable thickness, and are comparatively impervious, as is the case with the clays and loams of the oak-upland region, water collects in the depressions, forming the lakes which are so numerous in the uplands. Occasionally, but not very often in this part of the state, these sinks are drained by underground channels.

In some parts of the peninsula, where the surface-beds are mostly sandy but of great thickness, lakes, ponds, and swamps, caused by the water collecting and standing in the depressions, are as numerous and as characteristic as in the upland region, and this is notably the case along the water-shed between the Atlantic and the Gulf; but, as a rule, in the lower part of the state the surface-beds are both sandy and of no great thickness, and the rain-water soon soaks through them to the underlying limestone. Where this is cavernous, as is usually the case upon the higher lands, the water passes by an underground channel to the larger streams or to the sea; or, after a subterranean course of greater or less length, it reappears at the surface as a "boiling spring" or a "blue spring", flowing thence by a short open "run" to the nearest large water-course or to the sea. A large proportion of the tributaries of the Saint John's, the Ocklawaha, the Suwannee, and other rivers are fed by such springs. An inspection of the map, especially along the Gulf coast, will show a great number of "rivers" which are merely the runs from limestone springs.

Where the limestone is more compact, or where the subterranean channels in the rock are from any cause obstructed, the water collects in the depressions, forming ponds and lakes as before. This is especially the case in those low-lying and flat lands which have not sufficient natural slope to secure proper drainage by means of streams. Large areas in many parts of Florida are nearly destitute of running water, in place of which are ponds and lakes.

The water of some of the limestone springs above mentioned is impregnated with sulphureted hydrogen, which is very evident to the taste, as well as perceptible by the sense of smell upon approaching. From accounts of various travelers, these sulphur springs are quite generally distributed throughout the state.

By reason of the great thickness of the surface-beds in the oak-upland region, and also along the water-shed of the peninsula, the underlying limestone seldom appears at the surface, and exerts, in consequence, comparatively little influence upon either soils or topography, except in the formation of the lakes. Southward, however, in many parts of the peninsula, from its proximity to the surface, the limestone, in its reaction upon the overlying sandy soils, is directly concerned in the formation of the "high hummocks", "prairies," and other agricultural features.

AGRICULTURAL FEATURES.

The agricultural relations of Florida may conveniently be considered under the following general subdivisions or regions:

I.—Oak, Hickory, and Pine Upland Region, subdivided into—
1. The red lime-lands.
2. The brown loam uplands, with oak, hickory, and short-leaf pine.
3. The long-leaf pine ridge lands.

II.—Long-leaf Pine Region, with its subdivisions:
1. Pine lands.
   - *a.* Rolling pine lands. — First class. / Second class. / Third class.
   - *b.* Pine flats (Flatwoods). — Second class. / Third class.
2. Hummock Lands.
   - *a.* High hummocks.
   - *b.* Low hummocks.
   - *c.* Gulf hummocks.

III.—Pitch pine, Treeless, and Alluvial Region.
1. Flatwoods (with pitch pine).
2. Swamp lands.
3. Prairies and savannas.
4. Everglades.
5. Marshes.

DESCRIPTION OF THE AGRICULTURAL REGIONS.

I.—The Oak, Hickory, and Pine Upland Region.

General features and subdivisions.—The uplands have a substratum of clay, or rather of clay loam, commencing usually about 20 miles from the coast and rising gradually toward the Georgia and Alabama lines. Throughout the uplands the red and yellow colors of the clayey subsoil are characteristic, the soil varying from a brown or chocolate-colored loam to a pale yellow and gray, the latter more or less sandy.

Strictly speaking, the upland region, with clayey subsoils, would comprise most of the northern tier of counties of middle and western Florida from Columbia county to the Perdido river; but east of Madison county and west of Jackson the distinctive features of the uplands are lost, being merged into those of the pine lands. For this reason the uplands on the map are restricted to an area averaging 25 miles in width from the Georgia and Alabama lines, and extending from the central part of Madison county, on the east, to central Jackson, on the west. The area thus included, together with several small upland tracts in Calhoun and Washington counties, is about 2,300 square miles.

It is to be understood that, while the clayey subsoils and other features of the uplands are not wholly wanting beyond these limits, they are of local occurrence, and cease to be characteristic. There are three principal soil varieties, which, with their intermixtures, represent the agricultural character of this subdivision. These are:

1. The red lime-lands.
2. The brown loam lands, with oak and hickory and short-leaf pine.
3. The long-leaf pine ridge lands.

Relative position and origin of these varieties.—The facts concerning the distribution of these soil varieties, together with the obvious inference regarding their formation, are briefly these:

Within the area of the uplands the red lime-lands have been observed only at the lowest levels, the upland pine woods occupying the high table-lands and the dividing ridges, while the oak and hickory or brown loam uplands are found intermediate between the two. The topography varies similarly, the red lands being gently undulating or nearly level, the pine lands the same, while the oak uplands, with their hills and valleys, present a variety in scenery exceptional in Florida. The soils vary from the sandy soil of the pine lands through the sandy loam of the oak uplands to the loamy calcareous clays of the red lands. From these circumstances it may be inferred that the pine uplands and table lands have suffered least from erosion. The sandiness of their surface soils is probably due to the fact that, through the scarcity of lime, the rains which for ages have fallen upon these areas have gradually caused the the finer clayey portions of the soil to sink deep below the surface, or floated them off, leaving the sandier material. Upon the slopes, or wherever the erosive power of water has been active, this tendency of the soil to become more sandy is counteracted by the continual removal of the sandy surface and exposure of the underlying clayey loam. The topography determined thus by erosion becomes more varied in such localities. And lastly, along the margin and in the vicinity of the water-courses comparatively level land is again reached. The drainage having cut down into the calcareous rocks which form the substratum of the entire state, the presence of lime in the soil, by rendering the clay flocculent, prevents it being carried down by rains, and keeps it at the surface, where its influence is seen and felt.

Areas.—The estimated area of the red lime-lands is 150 square miles, that of the brown loam uplands 1,190 square miles, and that of the pine ridge lands 960 square miles. This estimate includes also the occurrences of the soils in question outside of the limits of the uplands, as shown on the map: *e. g.*, in Walton, Washington, Calhoun, and Liberty counties.

1.—*Red lime-lands.*

It is only in Jackson county that lands of this character have been observed in large bodies. They characterize the country from Campbellton, or, rather, from Big creek, in Geneva county, Alabama, to Marianna, and thence eastward as far as the Big spring, 6 miles from Marianna, and northeastward in the direction of Greenwood, nearly to the Chattahoochee river; an area of from 6 to 10 miles wide, east and west, by 18 to 25 long, north and south, and estimated at about 150 square miles. This area occupies the valleys formed by the Chipola river and its tributaries from the latitude of Marianna northward. A small area of similar soil occurs in the Euchee valley, in Walton county, and near the headwaters of Alaqua creek, in the same county. Near Vernon, in Washington county, the soil, though limy, is not so characteristically red. In all these spots white limestone of Vicksburg age lies near the surface (1 to 8 feet), but often outcrops, and to this admixture of lime is probably due most of the exceptional fertility of the soil.

The face of the country is tolerably level or gently undulating, with no considerable inequalities, and is not much elevated above the water-courses. The lands are generally cleared and in cultivation, and the farms were once large and flourishing, as is indicated by the white frame houses and tastefully laid-out yards, which in a few instances are still kept up, but since the war have mostly been allowed to fall into decay. The greater part of the population consists of negroes, as is the case also in the adjoining states wherever rich farming lands occur. The soil varies from a heavy red clayey loam to a grayish sandy loam where it borders the pine lands, and a brown sandy loam adjoining the oak uplands. The subsoil is a red clay, sometimes bluish, and this is underlaid at a depth of 1 to 8 feet by the calcareous rocks above mentioned.

The white limestone which is found through all this area varies in character from a soft, white, friable rock, made up almost entirely of shells, such as *Orbitoides Mantelli*, *Nummulites floridana*, through a white chalky substance, apparently devoid of fossils, (*a*) to a hard cherty limestone with flinty concretions. Although this rock in its several varieties is found in nearly all parts of Florida, often very near the surface, and sometimes even outcropping over considerable areas, yet this particular kind of red soil occurs only in the northern and western parts of the state. This circumstance may be due to the fact that the soil, which is here marled by the underlying limestone, is itself a tolerably fertile loam. In other localities east and south where the limestone approaches the surface the soil is more sandy, and it is probable that the differences observed in the characters of the hummocks of the peninsula and the red lime-lands of this part of the state (both of which owe their existence to the influence of the limestone) may be traced to differences originally existing in the soils themselves. Similar red soils have been observed in parts of Alabama and Mississippi.

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a Occasionally this rock is in composition nearer a sandstone, having only 2 to 3 per cent. of lime.

The prevailing growth upon these red lime-lands consists of several species of oaks, such as red, post, Spanish, and black oaks, some hickory and short-leaf pine upon the uplands, and willow and water oaks, spruce pine (*P. glabra*), beech, sweet gum, poplar (*liriodendron*), etc., in the bottoms. The typical red soil belongs rather to the lowlands than to the uplands.

With changes in the quality of the soil are associated changes in the timber; for with increasing sandiness the long-leaf pine associates itself with the trees above named, and such trees as the beech, the poplar, the willow, and water oaks disappear.

The composition of soils of this character is fairly shown by the following analysis of a soil taken from the lowlands bordering on Spring creek near Campbellton. The yield in seed-cotton of the fresh land is estimated to average about 1,500 pounds per acre:

No. 1. *Red loam soil* from lowlands of Spring creek.—Growth, hickory, sweet gum, post, red, and Spanish oaks, with short-leaf pine; color, reddish brown. The sample was taken to the depth of 10 inches.

Red loam soil (lime-lands), Jackson county.

	No. 1.	
Insoluble matter	84.240	87.490
Soluble silica	3.256	
Potash		0.072
Soda		0.019
Lime		0.266
Magnesia		0.105
Brown oxide of manganese		0.077
Peroxide of iron		1.456
Alumina		6.885
Phosphoric acid		0.222
Sulphuric acid		0.088
Water and organic matter		4.058
Total		100.678
Hygroscopic moisture absorbed at		4.291 21 C.°

This analysis shows a deficiency of potash, but the soil is nevertheless thrifty, because of the lime, which is present in considerable quantity, and an adequate supply of phosphoric acid. The red soils of Murder creek, near Evergreen, Alabama, are of a similar nature.

2.—*Brown loam lands, with oak, hickory, and short-leaf pine.*

The rolling and sometimes hilly country included under this head is in general aspect and in timber entirely similar to the corresponding areas in Georgia and Alabama. The elevation of these uplands varies between 75 and 200 feet above the main water-courses, the latter figure being probably much nearer the average. Geologically considered, they are formed by beds of varying thickness of stratified drift or orange sand (sometimes 75 to 100 feet), with a capping of red or yellow loam 5 to 20 feet thick, both overlying limestone of the Vicksburg age.(*a*) A characteristic of most of the better class of these upland soils is the deep red or orange color of the subsoil, due to the presence of hydrated ferric oxide. The subsoils in composition vary from tolerably stiff loamy clays to rather sandy loams, and the sandiness generally increases southward.

The largest continuous body of the oak and hickory uplands with clay-loam subsoils is found along the Georgia line in middle Florida, and includes Gadsden, northern Leon, northern Jefferson, and northwestern Madison counties, and in western Florida, including the northeastern part of Jackson county. These are the limits marked off on the map, in addition to which are small tracts in the other counties named below, and the area included is about 1,190 square miles. Beyond these limits small bodies of this kind of land, interspersed with predominating pine lands, and therefore represented as pine lands on the map, occur in eastern Florida, in parts of Hamilton, northern Suwannee, and northern Columbia; in western Florida in parts of Jackson, Washington, Holmes, Walton, and Santa Rosa; and on the peninsula in Hernando and Hillsborough counties. It is impossible, in the present state of our knowledge, to give a trustworthy estimate of the area thus represented. These areas are more conveniently considered separately.

Western Florida.—The oak uplands in this part of the state are not seen in any considerable bodies west of Jackson county, though small areas occur in Washington and Walton counties, as mentioned below. In Jackson county they divide the area rather unequally (as may be seen in the heading) with the red lime-lands above

a Occasionally the term "hummock" is applied to all classes of land (including these uplands) which support a growth of hard woods. In this report the word hummock is used with the restriction given below under the appropriate heading.

mentioned and the pine woods to be described below. The soil here is a sandy loam of a gray to brown color, resting upon a subsoil of stiff red loam, passing downward into red and orange-colored sands, intermixed occasionally with pebbles. The pebbles are found on both sides of the Chattahoochee and Apalachicola rivers for 15 or 20 miles, and mark with some precision the ancient bed occupied by the river during the period following the deposition of the drift, at which time it seems to have been one of the main water-courses leading to the Gulf.

In the eastern part of Washington county, and embracing part of northwestern Calhoun, a number of hills, including Orange and Hickory hills, possess a soil of this character.

In Walton county the Alaqua country is apparently of similar nature. Euchee valley, like some other good farming land southeast of Euchee Anna, appears from accounts to have a red clayey subsoil, and belongs rather to the preceding division of red lime-lands. The rest of western Florida is pine woods, in part pine uplands and in part rather low pine barrens.

Middle Florida.—In this area, as above defined, the oak uplands form from one-fifth to three-fourths of the tillable land. The country is broken and hilly, and the bright red or yellow color of the subsoil is sufficiently characteristic. The soil is usually a reddish brown to gray loam, becoming in places very sandy. The depth of soil to a change of tint is from 2 to 6 inches. As the lands lie generally very favorably with respect to drainage and the like, they are usually deemed the best farming areas of the state. The timber comprises the usual varieties of upland oaks, such as post, red, and Spanish, with black-jack on the poorer spots and hickory, short-leaf pine, with sweet gum, along the slopes and in the valleys. Most of the trees are draped with long moss (*Tillandsia usneoides*, L.). As this class of soil grades into the sandier varieties, so the short-leaf pine and upland oaks are gradually replaced by long-leaf pine and black-jack, there being all gradations between the pure oak and hickory uplands and the genuine pine woods.

Eastern Florida and the Peninsula.—In eastern Hamilton, Suwannee, and Columbia counties there are small areas of these uplands, but it is impossible to locate them definitely. Long-leaf pine is the prevailing growth over the greater part of these counties, and they are therefore best considered in connection with the pine ridge lands of this division or the long-leaf pine region below. In Hernando, and perhaps in Hillsborough county also, the high rolling lands, with reddish or yellowish loam subsoil, are probably of this character; but my information on this point is not definite. These soils are usually well drained and easily tilled in all seasons, and are about equally well adapted to all the southern crops, such as cotton, corn, oats, sugar-cane, and sweet potatoes, being perhaps more particularly suited to the upland cotton, which is cultivated upon from 50 to 60 per cent. of all the cleared land of this character. The yield in seed-cotton of the average upland loam soils is usually estimated at about 1,000 pounds on the fresh land. As representing the composition of a characteristic soil of this class the following analysis may be taken:

No. 2. *Upland brown loam soil*, from 6 miles northeast of Tallahassee, Leon county.—Depth, 9 inches; vegetation, post, red, and Spanish oaks, short-leaf pine, hickory, and sweet gum; color of the soil, brown.

Brown-loam upland soil, Leon county.

	No. 2.	
Insoluble matter	86.460	89.100
Soluble silica	2.640	
Potash		0.665
Soda		0.018
Lime		0.243
Magnesia		0.023
Brown oxide of manganese		0.024
Peroxide of iron		1.491
Alumina		3.977
Phosphoric acid		0.323
Sulphuric acid		0.011
Water and organic matter		3.982
Total		99.252
Hygroscopic moisture		4.150
absorbed at		21.1 C.°

This soil, like the preceding red-lime soil, is deficient in potash, though otherwise a fair soil, the high percentages of lime and phosphoric acid in both rendering them thrifty.

Throughout the region of the oak uplands two well-defined classes of low hummocks are recognized, and named, according to the prevailing material, sand hummocks and clay hummocks. These are usually associated closely with some water-course, and are, especially in the case of the sand hummocks, due to washings from the uplands. These will be mentioned more in detail under Gadsden county.

3.—*Long-leaf pine ridge lands.*

In this subdivision are included all those high pine lands which usually skirt the oak uplands, or which rather occupy the ridges separating the oak upland areas from each other. A classification of these lands into first, second, and third quality is in common use among the farmers. The soils are sandy loams, mixed with more or less of vegetable matter; the subsoils sandy, but underlaid by yellow or red clay loam, at depths varying from two or three to several feet. The largest continuous area of this kind is associated with the oak and hickory uplands above mentioned in Gadsden, Leon, Jefferson, and western Madison counties, in middle Florida, and in Jackson, northern Calhoun, Washington, and Walton counties, west of the Apalachicola.

In eastern Florida and in other parts of western Florida most of the pine lands are to be classed rather with the long-leaf pine region, as below defined.

As stated above, the oak uplands and pine ridges are estimated as dividing about equally (960 square miles of pine ridge lands, 1,190 oak uplands) the whole upland region. The surface configuration of this class of land is varied. In Gadsden county there is a large body of high, level table-land, with small inequalities of surface, except where it breaks off toward the water-courses. This table-land soil would probably be rated as second class, and while too unproductive for ordinary crops without manures, it has lately been coming steadily into favor, as it has been found that with the moderate use of commercial fertilizers it produces quite well, is easily tilled, and is very safe.

Through Holmes, Calhoun, northern Washington and Walton, Santa Rosa, and Escambia counties the pine lands are high and rolling, and mostly of second and third quality, with smaller bodies of first-class land. It is more convenient to treat these in connection with the long-leaf pine region, though they partly belong here. In these counties, as also in Jackson, the third-class lands have usually a scrubby growth of pine and high-ground willow oak (*Q. cinerea*), turkey oak (*Q. catesbæi*), and shrub oak (*Q. pumila*). To these are added, with gradual improvement of the soil, black-jack, post, and other species of oak, with short-leaf pine, forming a gradual transition into the oak uplands. On the other hand, the pine ridge lands grade off imperceptibly into the low pine barrens, with cypress swamps and undergrowth of saw palmetto.

The distinction here made between the upland and the low pine lands is based upon the existence in the first case of underlying beds of red and yellow sandy and clayey loams and their absence in the latter case, rather than on any marked difference in the general character of the land and the vegetation; for whether upland or lowland the same characters of surface soil will be productive of about the same class of pine woods. The pine uplands or ridge lands vary greatly in their productiveness. The third-class lands do not pay for cultivation; the second class are scarcely cultivated without manure; but the average yield of the first-class lands may be put at 500 pounds, though in many cases the yield is given at 1,000 pounds of seed-cotton to the acre. Sea-island cotton succeeds well on this soil. The table-lands of Gadsden county may be considered as fairly representative of the second-class pine lands, and, while they are scarcely ever cultivated (in cotton) without the use of fertilizers, with fertilizers very fair returns are always reached. The following analysis shows the character of this kind of soil:

No. 8. *Table-land soil*, Mount Pleasant, Gadsden county (S. 5, T. 3, R. 5 W.).—The color remains without change to a depth of 6 inches, below which it passes into that of the subsoil, which is a yellowish sand, with a slight intermixture of yellowish clay. The clayeyness increases downward, and at a depth of 2 to 6 feet it becomes a hard yellow clay, with brownish, sometimes black (iron) pebbles in places. Depth at which sample was taken, 9 inches; natural growth, long-leaf pine, round and narrow leaf black-jack, red and post oaks, some hickory, with undergrowth of oak runners, low bush whortleberries, devil's shoestring (*Tephrosia Virginia*), wild oats, vanilla, and other weeds, and wire-grass.

Pine upland soil, table-land, Gadsden county.

	No. 8.	
Insoluble matter	93.362	95.083
Soluble silica	1.721	
Potash		0.045
Soda		0.018
Lime		0.064
Magnesia		0.065
Brown oxide of manganese		0.220
Peroxide of iron		0.941
Alumina		1.339
Phosphoric acid		0.066
Sulphuric acid		0.091
Water and organic matter		2.422
Total		100.294
Hygroscopic moisture		1.830
absorbed at		21.1 C.°

As will be seen, this is essentially a poor soil, being notably deficient not only in potash, but also in lime, phosphoric acid, and magnesia. Its lack of retentiveness of moisture is also to be remarked. The under subsoil of clay loam, however, causes it to retain and profit by all the artificial fertilizers which may be applied, and hence, with small outlay for these aids, fair crops may always be expected. The sea-island variety of cotton grows well upon this soil, which seems, moreover, to be specially suited to grape culture.

II.—Long-leaf Pine Region.

General features and classification.—In the most general terms the soil varieties occurring within the limits of the long-leaf pine region may be grouped under the three heads of pine lands, hummocks, and swamps.

In those parts of Florida where the long-leaf pine forms the principal timber there are three kinds of pine lands, which, in their extremes, may easily be recognized. These are the long-leaf pine uplands or ridge lands, the rolling pine lands, and the pine flats or "flatwoods". The first of these is associated with the oak uplands above mentioned, occupying usually the ridges and plateaus intersecting the same. The sandy top soil of these elevated places, formed in the manner already described, is underlaid with beds of red and yellow clayey sands and loams of notable thickness. These are the pine uplands which have already been described.

In the second and third kinds of pine lands the subsoil is never a red clay, but is at best a light-yellow sandy loam, grading into light-colored sand or sandy clay, the whole resting upon the Tertiary limestone of the state, which can be found at varying depths below the surface.

The pine lands of the upper counties of middle Florida, adjoining the Georgia line, and of the eastern counties of western Florida belong generally to the first kind, as they are more or less closely associated with the oak uplands, and have red or yellow clayey loam subsoils. Eastward and westward, however, from these uplands, and adjoining the Georgia and Alabama lines, the underlying red and yellow loams either thin out or change so much in character as to give to the pine lands of these sections most of the features of the long-leaf pine region proper, which includes the rolling pine lands and the pine flats of the above division. It is in many cases a mere matter of choice or of convenience to which of these divisions a particular tract of pine lands shall be assigned, and they have been restricted to the limits above given, while the great bulk of them have, for convenience of treatment, been reserved for description under the present heading.

The pine lands adjoining the Alabama and Georgia lines as far east as the middle of Hamilton county, and occupying, with an exception presently to be noted, the central portion of the peninsula as far south as the middle of Polk county, are gently undulating and sufficiently elevated to secure good drainage. These constitute the rolling pine lands of this division, and correspond to the lime-sink and wire-grass division of Georgia and Alabama.

South of the Okeefenokee swamp, in Columbia, Baker, Bradford, and Clay counties, and skirting the rolling pine lands east, south, and west toward the coast, are level, generally badly-drained bodies of poor land, known as pine flats, or flatwoods.

The area first mentioned, that south of Okeefenokee swamp, has considerable elevation above the sea (at least 200 feet); the other pine flats are seldom more than 40 feet above tide, sloping gradually down to 15 or 20 feet elevation. Near the coast, and especially south of latitude 27°, the Cuban or pitch pine (*P. Cubensis* Grisebach, *P. Elliottii* Engelmann) partly or wholly replaces the long-leaf species (*P. australis*).

The estimated area of the long-leaf pine region, exclusive of the pine ridge lands of the preceding section, but including the flatwoods and hummocks, is 28,650 square miles.

The rolling pine lands are of all three qualities; the flatwoods are mostly third-class lands, sometimes second class, but never first. Throughout the long-leaf pine region are interspersed subordinated areas of hummock lands, as described below.

To complete the enumeration of the soil varieties occurring in the long-leaf pine region it would be necessary to include swamp lands and prairies; but as these are more conveniently treated in the next division, a mere mention of them will suffice here.

Wherever the underlying limestone of the country has only a thin coating of the surface materials lime-sinks and outcroppings of the rock itself are of frequent occurrence. Around the borders of the sinks the jagged edges of the limestone are usually exposed. These sinks have sometimes an underground outlet, by which waters collecting in them are drained away, and as the soil-covering is usually thin they are often destitute of timber, but are covered with a dense carpet of grasses, constituting prairies, and, when somewhat wet, savannas. The sinks in the limestone, when without outlet, are soon filled with water, thus forming lakes or ponds, according to size. Payne's prairie, formerly also called the Alachua savanna, is at the present time a lake, the change from prairie to lake having been caused by the obstruction of the underground outlet.

The subterranean streams, as above stated, often come to light in big springs, which are usually at no great distance from some water-course or the sea, with which they are connected by a short open run. This position of the springs near the coast or near water-courses is obviously determined by the greater amount of erosion in such localities.

1.—*Pine lands.*

a. Rolling pine lands.—As has already been stated, the pine lands belonging to this division are rolling or gently undulating, and are sufficiently elevated to secure good drainage. The counties and parts of counties included under this division are Escambia, Santa Rosa, Walton, Holmes, Washington, Jackson, Calhoun, Liberty, Madison, Hamilton, Suwannee, Columbia, Nassau, Duval, Clay, Putnam, Alachua, Marion, Hernando, Hillsborough, Sumter, Orange, and Polk; in general terms, embracing those pine lands lying adjacent to Alabama and Georgia (except the oak uplands, already described, and the flatwoods area south of Okeefenokee swamp), and occupying the central part of the peninsula to the southern limits above given. The whole area thus included may be put at 15,120 square miles. The map shows the distribution.

Irrespective of the topographical character of the country (whether rolling lands or flatwoods), the classification of the pine lands in common use among the farmers of the state, and for that reason adopted in this report, is into first, second, and third class.

These three qualities of pine land appear to depend in great measure upon the admixture of varying quantities of loam with the prevailing sandy soils. Of the distribution of these varieties not much can be said definitely. In general, however, the third-class soils form the surface of most of the barren ridges, separating more fertile areas.

First-class pine-land soil.—This is a dark-colored sandy loam, usually underlaid with a stiff loam, approaching a clay. In the upland region, already described, the underlying loam of the pine lands is quite stiff, clayey, and usually of a tolerably deep red color. In the long-leaf pine region proper it has a much higher percentage of sand, and lacks the red color almost entirely, having at most a shade of yellow.

The surface of the country is usually gently rolling, and has considerable elevation above sea-level. The natural growth is long-leaf pine, with Spanish and red oaks and hickories.

The soil is well adapted to the cultivation of sea-island cotton, and when fresh will yield, under favorable circumstances, from 500 to 700 pounds of seed-cotton to the acre. A soil collected in Marion county, of which an analysis is subjoined, is a good type of this class.

No. 6. *Oak, hickory, and pine lands soil.*—Depth, 10 inches; vegetation, red oaks, hickory, and long-leaf pine, and wire-grass; locality, 9 miles north of Ocala, Marion county.

First-class pine-land soil.

	No. 6.	
Insoluble matter	94.460	96.125
Soluble silica	1.665	
Potash		0.189
Soda		0.038
Lime		0.072
Magnesia		0.039
Brown oxide of manganese		0.055
Peroxide of iron		0.321
Alumina		0.915
Phosphoric acid		0.110
Sulphuric acid		0.091
Water and organic matter		1.884
Total		99.839
Hygroscopic moisture		2.138
absorbed at		26.1 C.°

Second-class pine-land soil.—This, like the first, has a clayey or loamy substratum. It is usually, however, a little more sandy and somewhat less productive. These lands are sometimes high and rolling, sometimes nearly level, interspersed with areas of swampy land, and this appears often to be the case upon or near the dividing ridge above spoken of. The natural timber is chiefly long-leaf pine, to which are added occasionally high-ground willow oak (*Q. cinerea* Mich.), black-jack, and post oaks.

I subjoin an analysis of a soil of this kind taken from the vicinity of Lake City. In this neighborhood the lands are comparatively level, and swampy tracts alternate with pine lands. The elevation above the sea is considerable, this being upon the water-shed. The average yield of seed-cotton (long staple) is about 350 pounds. As was stated above with reference to similar soils upon the uplands, these are not commonly planted in cotton without manure.

No. 7. *Gray sandy pine-woods soil* from 5 miles north of Lake City, Columbia County.—Depth, 10 inches; vegetation, long-leaf pine and wire-grass.

Second-class pine-land soil.

	No. 7.
Insoluble matter	95.630 } 96.509
Soluble silica	0.879 }
Potash	0.117
Soda	0.064
Lime	0.058
Magnesia	0.042
Brown oxide of manganese	0.049
Peroxide of iron	0.224
Alumina	0.473
Phosphoric acid	0.092
Sulphuric acid	0.058
Water and organic matter	1.807
Total	99.493
Hygroscopic moisture	1.643
absorbed at	24.5 C.°

A comparison of these two analyses will show at once the relations of the two classes of soil. With nearly equal amounts of insoluble matter, the first is richer in potash, phosphoric acid, and lime, and its larger content of iron and alumina and greater capacity for absorption of moisture make it superior in physical condition, as well as in chemical composition. Neither, however, is a high-grade soil, the deficiency in lime and potash being most marked.

Third-class pine-land soil.—The sandy ridges which traverse this region have both soil and subsoil very sandy. The natural growth is indicative of the poverty of the soil, and consists of long-leaf pine, mostly small and worthless for timber, shrubby oaks (*Quercus pumila*, *Q. cinerea*, *Q. falcata*, *Q. ferruginea*, *Q. virens*, *Q. Catesbæi*), occasionally small hickories, sour-wood (*Andromeda*), and whortleberries (*Vaccinium*). These barren ridges alternate with the better qualities of pine lands. The name "pine barren" is applied to third-class lands.

b. Pine flats, or flatwoods.—In the direction of the coast the rolling pine lands are bordered with a margin of greater or less width of low, flat, badly-drained lands, which become water-soaked in wet weather. For this reason they are seldom cultivated, but, as grass flourishes upon them, they are usually well suited for pastures. These flats embrace parts of the following counties: Escambia, Santa Rosa, Walton, Washington, Calhoun, Liberty, Wakulla, Jefferson, Taylor, Lafayette, Levy, Hernando, Hillsborough, Polk, Manatee, Orange, Brevard, Volusia, Putnam, Saint John's, Clay, Duval, and Nassau, aggregating about 11,250 square miles. Beside this belt, there is upon the elevated land of the peninsula, on the divide between the waters of the Atlantic and the Gulf, a similar tract of flat, wet land, differing from that of the coast principally in its greater elevation. Parts of the counties of Columbia, Baker, Bradford, Putnam, Clay, Duval, and Nassau are of this character, and this area includes about 2,280 square miles, the whole area of the long-leaf pine flatwoods being 13,530 square miles.

In the flatwoods second- and third-class pine soils are only represented, with which, along the coast, are associated Gulf hummocks, and in all parts areas of swamp land.

The more or less sandy soil of the flatwoods is usually underlaid by a clayey substratum or a densely-packed sand, which is impervious, and this, together with the low position and level surface, prevents proper drainage, and produces a water-soaked soil that cannot be profitably cultivated. For similar reasons, swamps are everywhere associated with the flatwoods. The principal growth is long-leaf pine, black-jack oak, saw palmetto (*Sabal serrulata*), and gallberry (*Prinos glabra*). In this division the pine lands are mostly of third class, there being very little of the second class.

Barrens.—Throughout the long-leaf pine region the poorer classes of land are termed pine barrens. The growth upon these is mostly long-leaf pine and black-jack, with shrubby oaks of other species. In the flat pine barrens saw palmetto and gallberry bushes are common.

While the undergrowth of shrubs in the barrens is sometimes scarce, and often wanting entirely, the herbaceous undergrowth is rich and varied, embracing nearly half the flora of the state. In most pine barrens slight sinks or basins in the surface, which are filled with water in wet seasons and are moist at all times, are of frequent occurrence, and these places have a large and characteristic flora.

Scenery and vegetation of the long-leaf pine region.—The most prominent characteristics of this region as regards surface configuration and natural growth have already been enumerated under the several divisions. Wire-grass (species of *Aristida*, chiefly *A. stricta*) grows upon nearly all the varieties of pine land, and in some places it forms almost the entire undergrowth.

Where the shrubby undergrowth is scanty or wanting, one can see for great distances between the straight trunks of the pines, and over the gently undulating surface a wagon may be driven for miles in any direction without need of following any beaten track.

Limiting the term as defined above in the general part, the area of the several kinds of hummocks associated with the pine region, and excluding the so-called hummocks of the upland region, may be given at from 2,500 to 3,000 square miles.

a. High hummocks.—Throughout this agricultural division of the state (long-leaf pine region) there are areas of what is called high hummock land, in contradistinction to the low hummock land of the streams and water-courses. This land supports a vigorous growth of "hard woods", such as live and other oaks, hickory, magnolia, bay, sweet bay, long-leaf pine, cabbage palmetto, cedar, elm, and linden.

The color of the soil varies from brownish red to nearly black; is always more or less sandy, and its thickness varies from 8 to 12 inches, the subsoil being sometimes sandy also, but oftener a marl or limestone. Earthy disintegrated limestone of Eocene age underlies invariably, so far as observations go, the whole of these hummocks. Usually fragments of the rock are to be found mingled with the surface soil, and nearly always with the subsoil.

The yield of long-staple seed-cotton per acre may be put, on an average, at 500 to 700 pounds for fresh land.

The general principles which bear upon the mode of formation and distribution of hummock lands have been mentioned above, and from this it will be seen that the distribution of the high hummocks through the prevailing pine lands, depending as it does upon the local character of the underlying limestone and upon the degree of its intermixture with the surface soil, cannot be laid down with any degree of accuracy upon a map without close and detailed surveys of the whole country.

A few of the largest and best known areas of such hummock lands may be mentioned.

In Lafayette county are Cooke's and Old Town hummocks, and in Marion county, near Ocala, begins a strip of hummock land which stretches away toward the southwest, through Sumter, into Hernando county. In the latter county there are two of the largest bodies of hummock land in the state, known as the Annutalaga and the Choccochattie hummocks. Further details concerning these will be found in the county descriptions.

A specimen of soil from the hummock near Ocala was collected for analysis, and it may be looked upon as a representative of this class.

No. 5. *High-hummock soil*, from 1 mile south of Ocala, Marion county.—The soil is of grayish "pepper-and-salt" color. Depth, 10 inches; vegetation, live oak, white and water oaks, hickory, bay, sweet and sour gum, magnolia.

High-hummock soil, Ocala, Marion county.

	No. 5.	
Insoluble matter	90.585	91.965
Soluble silica	1.380	
Potash		0.112
Soda		0.035
Lime		0.185
Magnesia		0.033
Brown oxide of manganese		0.027
Peroxide of iron		2.048
Alumina		2.494
Phosphoric acid		0.110
Sulphuric acid		0.054
Water and organic matter		3.583
Total		100.646
Hygroscopic moisture		4.210
absorbed at		26.6 C.°

A noticeable feature of this soil is the large percentage of lime, iron, alumina, and organic matter which it contains, as compared with other Florida soils from the long-leaf pine region.

b. Low hummocks.—Along the margins of many of the lakes and streams of the long-leaf pine region, and in some of the low, swampy areas not connected with any running water or lake, are the low hummocks, with cypress, cabbage palmetto, saw palmetto, hickory, live oak, water oak, bay, evergreen, etc. These hummocks appear to be generally rather more sandy in character of soil and subsoil than the high hummocks, and the admixture of lime is less obvious, especially on what are called the light-gray hummock lands. There seems, however, to be very little reason to doubt that it is the influence of the underlying limestone, felt through the intervening beds, which gives to the soils of all the hummocks their greater degree of fertility.

The yield of the light-gray sandy hummock land may be put at about 400 pounds of seed-cotton (sea island) to the acre when the land is fresh.

The following may be taken as showing the composition of the light-gray hummock lands:

No. 4. *Light hummock soil*, Leesburg, Sumter county.—Color, light gray, "pepper-and-salt;" depth, 8 inches; vegetation, hickory, live oak, water oak, red bay (*Persea Carolinensis*), evergreen, and saw palmetto.

Low-hummock soil, Leesburg, Sumter county.

	No. 4.	
Insoluble matter	97.350	97.564
Soluble silica	0.214	
Potash		0.052
Soda		0.015
Lime		0.077
Magnesia		0.019
Brown oxide of manganese		0.032
Peroxide of iron		0.214
Alumina		0.628
Phosphoric acid		0.079
Sulphuric acid		0.053
Water and organic matter		1.675
Total		100.408
Hygroscopic moisture		1.199
absorbed at		23.8 C.°

c. Gulf hummocks.—Along the Gulf coast, especially from Wakulla county down to Hillsborough, there are frequent spots, sometimes quite extensive, where the Tertiary limestone lies near the surface, and its reaction upon the sandy soils brings about the modification known as Gulf-hummock land. This land will yield a bale of lint (sea-island cotton) to the acre in some localities; the average, however, would probably be less. The growth is the usual hummock growth given above. The color of the soil in some localities in Wakulla county is light gray, nearly white, looking very much like white sand. In this place the limestone is a white pulverulent mass, with shells, and has the following composition:

Marl from Wakulla county.

Insoluble matter	35.555	39.011
Soluble silica	3.456	
Potash		0.372
Soda		0.338
Lime		30.986
Magnesia		0.424
Brown oxide of manganese		0.134
Peroxide of iron		0.534
Alumina		1.196
Phosphoric acid		0.014
Sulphuric acid		0.331
Carbonic acid		24.253
Combined water		1.159
Moisture driven off at 100°		1.915
Total		100.667

The intermingling of this substance with the sandy soils gives to this hummock its high degree of fertility. No analyses have yet been made of any Gulf-hummock soil.

III.—Pitch pine, Treeless, and Alluvial Region.

Under this head are included flatwoods (pitch pine), swamps, prairies and savannas, everglades, and marshes.

The grouping of so many seemingly diverse things in one division is justified by the following circumstances: They are all, with the exceptions presently to be noted, closely associated geographically, together forming the whole of the peninsula south of the line joining cape Canaveral with the head of Charlotte harbor.

The pitch pine grows all along the Gulf coast, and has been designated as *Pinus Elliottii* Engelmann, in the northern portion of its area of occurrence, while southward it is named *Pinus Cubensis* Grisebach, by Professor Sargent, who considers it identical with the Cuban pine. The coast marshes and swamps also are not confined to the lower end of the peninsula, the treeless portions being practically mere modifications of one and the same thing, brought about by varying degrees of moisture and by changes from salt to fresh water. Thus, a savanna may be

looked upon either as a fresh-water marsh or a wet prairie, or as a part of the Everglades not submerged. Finally, for the special purposes of this report, they may be well classed together, since none of them are of any importance in the cultivation of cotton. Only two bales are reported from the whole territory.

Where the lands of this division are under cultivation at all they are devoted to corn, sweet potatoes, and sugar-cane, and especially to tropical fruits; but by far the greater proportion of them, even where not submerged, is practically uncultivated. They constitute now, and are likely long to remain, the great natural pasture-grounds of the state.

The timbered portions of the above group, viz, the swamps and pine flats, as well as part of the sea marshes, are not confined to the extremity of the peninsula, as the map will show.

General description.—The relations between the flat lands of the coasts and the uplands, and a comparison between the Gulf and Atlantic coasts, have been very clearly stated by Colonel J. L. Williams in his account on Florida, already referred to, and no apology is needed for reproducing his descriptions here:

The Gulf coast from the mouth of the Perdido river to cape San Blas is formed of white sand, mixed with some calcareous particles of broken shells, and the cabbage-palmetto region extends often quite to the sea-shore. Occasional live-oak hummocks are met with along this part of this coast. From cape San Blas to Apalachee bay the sand becomes of a yellowish brown color, and extensive salt marshes alternate with the sand-hills.

From the Apalachee or Saint Mark's river to the Suwannee, a distance of 80 miles, a soft calcareous rock forms the sea-coast. It is uniformly covered with coarse grass and rushes, which extend from the woody coast several miles out to sea. This limestone forms the base of the peninsula and of the Florida keys; but in the Apalachee bay it is sheltered from the storms, and is very shoal, so that at low tide the sea appears like a green meadow 5 or 6 miles from the coast. This rock resembles chalk, and is generally of an ash color; some of it, however, is quite white, and is used for chalk. A kind of imperfect flint is embedded in it, in form of a shelly nucleus. It becomes hard on exposure to air. The flint is of a light-gray color, full of holes, which are filled with the calcareous matter. It breaks with a conchoidal fracture, gives fire freely with steel, is quite opaque, but is void of the greasy feel which is peculiar to pure flint. On points of the coast where the waves have washed the calcareous matter away these flinty nuclei form extensive and very rugged reefs. Along the shores of Apalachee bay the forests rarely approach within 3 or 4 miles of the tide. On the marshes, however, there are frequent keys, which rise like small islands, covered with live oak, cedar, and tall cabbage palmetto. These are most frequent where streams of water enter the bay. The high grounds bordering the marshes are usually rocky, but are covered with a great variety of heavy timber.

A ridge of lime rock runs parallel with the coast, and 8 or 9 miles distant (inland) it does not rise much above the surface, but causes falls in all the streams between the Saint Mark's and the Suwannee. For a distance of 15 or 20 miles from the coast this rock is but slightly covered with sand; small streams are rather scarce and sink-holes are frequent, in which the water is rather cool, but, like the rivers, highly tinctured with lime. This tract of flat country is generally covered with yellow or long-leaf pine timber, under which grasses grow luxuriantly, and it is a good grazing country. From this level tract of pine land the country rises over gentle swells, underlaid with red and white clay, into the uplands, covered with brown-loam soil, and crowned with wide-spreading oaks and tall hickories, mixed with liriodendron, magnolia, and gum. The uplands rarely approach to within 18 miles of the coast. In places the flatwoods form indentations extending many miles further inland.

South of the Suwannee the shore and the keys present a bare rock, with small trees of cabbage palmetto and cedar growing in the crevices as far as the Anclote keys. Beyond these the sea beats heavily on the shore, and makes a rough coast as far south as cape Roman. The pine barrens here usually extend to the rocky shore. About the twenty-seventh degree the coral formations begin to cover the calcareous rock above mentioned. From Sarasota key down the coast, and around on the eastern shore as far as the Soldier's key, this coral formation is prominent on all the Florida keys. Key Biscayne is sandy, as is the coast north of it as far as Jupiter inlet. Thence the *coquina* rock lines the coast as high as Anastasia island, in front of Saint Augustine; here it ceases, and no sign of this formation is seen north of this inlet. Coral formations are seen in Indian river even as high as Halifax river, but in no proportion to those of the western coast. North of Saint Augustine the whole coast is formed of white siliceous sand as far as the Saint Mary's.

We resume now the description of the flat lands:

The flat lands, reaching down to the coast as far south as the Suwannee river, have already been described above. Below the Suwannee the Wacasassee river empties its waters behind the Cedar keys through a low, marshy coast. The country then rises through rich Gulf hummocks into a series of sandy ridges, occasionally broken by masses of limestone, to the Alachua country, a name originally applied to a rich tract of land 30 or 40 miles in extent, but wholly undefined as regards boundary. This name has since been given to a county which embraces the original Alachua. This part of the country is diversified with savannas, lakes, ridges of hummocks, and plains of pine barrens. The soil is equally various. Some of the savannas are large and covered with a tall grass, and an adjoining ridge of sand-hills will remind one of the sea-coast, the hummocks presenting groves of live oak, exactly similar to the shores of the Gulf, which are, however, 25 to 30 miles distant. South of this, toward the Withlacoochee, the land falls off in the direction of the coast in gentle swells of pine land.

On every part of the country watered by the Withlacoochee the lands are diversified with rich hummocks, dense swamps, pine flats, wet savannas, and extensive grassy ponds. South of the Withlacoochee, and near the sea-coast, is an extensive tract of rich swamp land, 8 or 10 miles in length and from 3 to 4 in breadth. From Tampa bay to Peace creek the country is, in general, flat and rather poor as far south as Charlotte harbor.

About the twenty-seventh degree of latitude the vegetation begins to change rapidly. Oaks and yellow (long-leaf) pines become rare, and at length disappear altogether. The howey (a species of fig), caccaloba or sea-grape, and gum elemi take their place on the sea-coast, and p tch pine takes the place of the yellow pine in the interior.

On the eastern or Atlantic side of the peninsula the flat lands are in general rather wider than on the Gulf side. They are mostly flat pine lands, diversified with streams of good water. There is little difference, either in soil or productions, from the Saint Mary's to Mosquito inlet. The sea-coast is covered with the palmetto. Two or three miles from the sea-shore there is a strip from 1 to 4 miles wide covered with excellent land, bordering on the lagoons that stretch parallel with the shore. West of that are flat pine lands. South of Mosquito inlet and of Volusia, on the Saint John's, the country changes rapidly. Vast grass meadows and savannas, diversified with clusters of cabbage palms and live oaks, are separated by strips of pine land and hummocks of wild orange, and verges fast toward a tropical complexion, which increases as you approach cape Florida.

The interior of the peninsula south of the twenty-seventh degree of latitude is even yet imperfectly known. In soil and productions it varies considerably from the northern part of the state.

The shores and islands of the south are uniformly covered with mangrove bushes; these, as the cape (Florida) is approached, become forests of tall trees. This timber extends as far into the country as the salt water. The back country presents a singular alternation of savannas, hummocks, lagoons, and grass ponds, called all together the Everglades. They are drained north, east, and west by a great number of streams, more particularly mentioned elsewhere. There is a curious contrast between the calm and gentle swells of the Gulf of Mexico and the furious surf that eternally lashes the Atlantic coast. The tide in the Gulf rises only 2½ feet, but on the Atlantic it rises more than 6 feet.

In the Gulf, on the western side of the peninsula, the soundings range from 7 to 14 fathoms at 20 miles from the coast; on the Atlantic, the same distance from the shore, in many places soundings are lost. The eddies of the Gulf Stream throw upon the eastern coast such a quantity of broken shells, called coquina, that from Saint Augustine to Key Largo the mouths of all the rivers are dammed up and their waters thrown back on the country. Such are the waters of Indian river, as well as of Hillsborough, Halifax, and Matanzas. These are shut out from the sea by banks of shells and sand from 15 to 30 feet high. The waters thus barred out from the ocean unite laterally and form extensive lagoons, peculiarly calculated for inland navigation. When the waters of these lagoons are greatly swelled by rains in the upper country they burst their shelly barriers and open a deep channel into the ocean, through which the waters are soon drained, and the waves again commence a natural dam to close the inlet. As soon as the shells are cast upon the shore the rains dissolve the calcareous matter, crystallization commences between the fragments, and the rudiments of a rock are formed.

The coquina formation extends from Anastasia island south beyond Indian river, but is scarcely ever more than 6 miles wide, and generally not more than 2. We think the formation began at the south; the rocks there appear much older than at Saint Augustine. Very small quantities of shell are thrown on the coast at cape Canaveral, while at Saint Augustine they are abundant. The strata are horizontal and of varying thickness. They have been quarried to the depth of 20 feet, but we have not been able to learn how much further they descend into the earth.

Areas.—This agricultural division embraces an area of about 23,290 square miles, of which 4,850 square miles are swamp lands, 5,840 square miles are coast marshes and flat lands, timbered with pitch pine, and 12,600 square miles are prairies, savannas, and everglades. The area of the Everglades, as estimated from the most reliable data available, may be put at 6,400 square miles.

1. *Flatwoods (pitch or Cuban pine).*—South of latitude 27°, as we have seen in the above extract from Williams' book, the pitch pine replaces in part or wholly the long-leaf species. Through the courtesy of Professor C. S. Sargent I am enabled to give other localities of this tree north of that parallel along the coast. From the map it will be seen that the flat lands along the coast from the Perdido river to Apalachee bay have as timber chiefly this pine. The same remark applies to the eastern or Atlantic coast from the Saint Mary's river to the end of the peninsula, and from Hernando county southward on the Gulf side. In Manatee and Brevard counties the flatwoods, which, alternating with prairies and savannas, make up the country, are timbered with pitch pine, and wherever the prairies, savannas, and marshes prevail this tree is characteristic. The area is little cultivated, being used almost exclusively as grazing grounds for vast herds of cattle.

2. *Swamps.*—These are of three kinds:

a. Those formed along the banks of rivers and other bodies of water by inundation. These are the richest and most extensive. Between them and the stream is usually a ridge of dry land, a sort of natural levee, formed of the coarsest part of the alluvial sediments, which is deposited immediately after leaving the current. This ridge prevents the waters from draining off as the river subsides. Swamps are usually densely covered with heavy timber, and this timber is tangled with innumerable vines, which renders them almost impenetrable (Williams). Of this kind are the swamps skirting the Saint John's, the Ocklawaha, and other rivers. Where high enough, these lands have occasionally been cleared and cultivated in corn and sugar-cane, to which they seem to be best suited. It has been demonstrated that they will yield four hogsheads of sugar to the acre. Large bodies of swamp lands are met with in central and southern Florida, embracing, according to estimate, over a million acres. Drainage is necessary in most cases to prepare them for cultivation.

b. The pine-barren swamps. These are natural basins, containing the waters of the surrounding country (Williams). The growth upon them is principally cypress trees and knees. Pine-barren swamps are frequently associated with the flatwoods above mentioned. While this kind of swamp and the flatwoods are often formed in the lowlands near the Gulf or the Atlantic, they together form quite an extensive area upon the dividing ridge, and at an elevation of from 150 to 200 feet above tide. The Okeefenokee swamp, in Georgia, the southern limit of which is in Baker county, Florida, is upon the high land; and southward down the peninsula, still upon the dividing ridge, are large bodies of swamp land of this character in Baker, Columbia, Bradford, Clay, and Putnam counties. (See map.) The basins occupied by these swamps appear in most cases to be caused by sinks in the underlying limestone.

It has been stated above that where a moderately thin coating of surface materials covers the country limestone the depressions or sinks in this rock are shown at the surface as hummocks, prairies, savannas, or lakes, according to the degrees of moisture or the quantity of water filling them. On the other hand, where the sand and soil over the limestone are of not inconsiderable thickness, such depressions are marked above by low hummocks, swamps, and lakes. And similarly, whether a water-course shall be skirted with a belt of hummock or of swamp land seems in great measure to depend upon the depth of sand and soil overlying the limestone and upon the degree of drainage; for where the influence of the limestone or marl is felt in the soil, and where surface waters are tolerably well drained off, hummocks result.

c Galls or sour-lands are spongy tracts, where the water continually ooze through the soil and finally collect in streams and pass off. They are the coldest soils, and the waters rising through them are frequently impregnated with sulphur and iron. When their foundation is alluvial matter, it is usually very thin, like quagmire, and the land may be shaken for acres in extent. When the base is sand, it is a lively quicksand, very dangerous for cattle.

These galls are usually covered with titi (*Cliftonia ligustrina*), loblolly bay, and others, vacciniums and vines (Williams).

In some of the swamps of southern Florida, and probably of other parts of the state also, beds of marine shells of recent species, and in some instances large bones, have been found at small depths below the surface soil. Of the character of these bones I can say nothing from personal knowledge, but I obtained large shells of a species of *strombus* or conch from a swamp near Sanford, Orange county.

3. *Prairies and savannas.*—On the peninsula, and especially in the lower part, where the limestone is close to the surface and the soil thin, there are large areas of treeless country, called prairies, and, when rather wet, savannas.

Savannas are no more than natural reservoirs, like swamps, except that they are covered with grass and herbs instead of with trees and vines. They are usually founded on clay or marl, but sometimes on hard sand. They are frequently extensive, and form excellent grazing lands.—*Williams.*

The transition from low hummocks through prairies to savannas and everglades is by imperceptible gradations, and they differ from each other only in degree of moisture and thickness of the soil overlying the limestone.

4. *Everglades.*—On account of the interest which attaches to this part of Florida, and the meagerness of the literature of the subject, I have subjoined the following extract from Williams' *Florida*, which gives perhaps the best published account of the Everglades:

That part of the peninsula of Florida that lies south of the twenty-eighth degree of north latitude declines toward the center in the form of a dish, the border of which is raised toward the coast. Near cape Florida this border is from 12 to 20 miles from the sea-beach. It is formed of the same calcareous rock which skirts the Gulf of Mexico as far west as the Apalachee river. This vast basin is filled with marshes, wet savannas, intersected by extensive lakes and lagoons, forming a labyrinth which, taken together, is called the Everglades. It is very little known. It is drained on every side by rivers of different dimensions. The Saint John's drains it on the north; the Saint Lucie, Greenville, Jupiter, New, Rattones, and Miami on the east; and Snake, Swallow, Caloosahatchee, and Macaco on the west. Behind cape Florida the glades approach within 12 miles of the coast. The inlets may here be ascended in one day, notwithstanding the swiftness of their currents.

On reaching the level of the glades a vast grass meadow is expanded, apparently as boundless as the ocean. You then pass on the winding lagoons from 6 to 12 miles westwardly, and the grass by degrees disappears, and you are left in an unexplored grassy lake, to which you can discover no bounds. It probably extends near to the eastern shore of the Gulf. The grassy borders of this lake are usually covered with water during the winter season; not so deep, however, as to hide the grass, which is very thick and tall. During the summer the ground is often dry and hard for 10 miles from the timbered land. This tract is at all times stocked with wild game, and would afford a superior range for cattle.

The border of savanna and prairie land which skirts the Everglades passes gradually into rocky pine land with *P. Cubensis*, which forms the rim of the basin occupied by the glades. This rim is on an average some 20 feet above the sea, but occasionally it rises to a much greater height, as on the border of the Saint Lucie river, where, according to Williams, the land is at least a hundred feet above the Atlantic.

5. *Marshes* are of two kinds, fresh and salt. The former are usually situated on the borders of some large body of water in the interior of the country; the latter on the sea-coast or near the estuaries of rivers.

There is a great diversity of marshes, and much depends on the substratum on which they are based. For instance, the most extensive marshes of west Florida are based on limestone, which renders them extremely fertile; some of the fresh marshes, on the contrary, are merely quicksands covered with a very thin soil, and are of course quite barren, while others have a clay foundation, and may be cultivated to advantage. Marshes produce no trees; a few shrubs sometimes skirt the edges of them. The salt marsh has been found to be an invaluable manure for our sandy soils. (*a*)

The principal grass-like plants growing in the salt marshes are as follows:

GRASSES.—*Spartina juncea, S. gracilis, S. glabra, Eustachys petræa, Leptochloa polystachya, Paspalum vaginatum, Muhlenbergia capillaris.*

SEDGES.—*Cladium effusum, Cyperus Nuttallii, Eleocharis albida, E. arenicola, Scirpus pungens, S. Olneyi, S. lacustris, S. maritimus, Fimbristylis spadicea, Juncus maritimus, J. scirpoideus.*

A few of the most important areas of coast marshes have been laid down upon the map. In some localities along the eastern shore of the peninsula, in Saint John's and Volusia counties, fine plantations were formerly cultivated, which were salt marshes drained. On all the water-courses in this part of the state there are extensive marshes, which are valuable, as the expense of draining is less than that of clearing the heavy timber from the swamp lands.

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a Williams, *Florida*, p. 96.

both kinds are cultivated, but chiefly the long staple. There is naturally no hard and fast line separating the areas producing these two kinds, and in the analysis of the enumeration results given below the counties where both staples are produced have been classed according to the predominant variety.

Soils.—Loamy soils, with somewhat heavy clayey subsoils, produce nearly all the upland cotton of Florida, while the sandy soils, with light loamy or sandy subsoils, are specially suited to the sea-island variety.

In the counties of Liberty, Calhoun, Washington, and Walton (which produce most of the short-staple cotton outside of the upland region proper) almost the entire crop grows upon those small, outlying areas with loam soils and clayey subsoils (described in the county details), and not upon the sandy soils, which characterize the long-leaf pine region as a whole.

Upon second-class sandy soils, where the upland cotton will barely attain the height of 12 inches, the sea-island variety appears to thrive, and may grow to the height of 3 or 4 feet.

With the same height of stalk the upland cotton seems to be more prolific of fruit, and the proportion of seed-cotton to the lint is greater than is the case with the long staple. The ratios of seed-cotton to lint are usually assumed to be 3 to 1 for upland cotton and 4 to 1 for the sea island; but in reality the yield of lint is seldom so high in either case

Ginning, baling, and weight of bales.—The lint of the upland cotton adheres closely to the seed, and in separating it a gin with steel saws is commonly used; but the saws have been found to injure the fiber of the long-staple cotton, and since the lint in this variety is very easily detached from the smooth, black seed, the roller-gin is used. In this gin the fiber is drawn by means of a leather roller between a metal plate and a blade which moves across the plate like the blade of a pair of shears, and thus knocks or beats back the seed. The saw-gins are all modifications of the Whitney gin, and those most in use are Pratt's, Brown's, Gullett's, and Carver's. Of the roller-gin, the McCarthy, or some modification of it, is in general use.

The short-staple cotton is packed by means of a screw or lever press into bales wrapped with coarse bagging and bound with iron or rope ties, the average weight of a bale being 475 pounds. This mode of packing has generally been considered injurious to the long-staple cotton, which is usually packed more loosely in a long bag, the open end of which is suspended so as to hang vertically, with the closed end touching the ground; and the cotton is put in and packed down by a man with an iron crowbar or pestle. In some parts of the country, however, the common screw or lever press is used for packing both long and short staple, and without any injury to the fiber of the former, so far as can be seen. The desired weight of a bag of sea-island cotton is 350 pounds.

Price and product per acre.—If we assume the average price of the upland cotton to be 10 cents a pound and that of the sea island to be 30 cents, we may get an estimate of the comparative values of the two varieties. (In making this estimate it will be understood that we take only the data furnished by the reports of the correspondents and the results of the enumeration.)

The product per acre of upland cotton is 0.24 of a bale (of 475 pounds), equal to 114 pounds of lint. This, at 10 cents a pound, will bring $11 40, from which must be deducted the cost of production, 7 cents a pound (average estimate of correspondents), or $7 98, leaving $3 42 average profit on one acre cultivated in upland cotton.

The product per acre of the sea-island cotton is 0.19 of a bale (of 350 pounds), equal to 67 pounds of lint, which, at 30 cents a pound, will bring $20 10; deduct 20 cents a pound ($13 40), cost of production, and the average profit on one acre cultivated in sea-island cotton will be $6 70.

Finally, with reference to the two varieties, it may be repeated that many of the sandy soils of the upland region east of the Apalachicola river, which until recently have never been planted in cotton at all, are now known to be well suited to the cultivation of the sea-island variety, and its production in this part of the state is evidently on the increase, although it has not yet reached any large proportions.

COMPARISON OF THE AGRICULTURAL REGIONS.—The five counties of Jackson, Gadsden, Leon, Jefferson, and Madison, which lie within the limits of the oak, hickory, and pine upland region, produce 69 per cent. of the cotton of the state (all short staple); the twenty-nine counties of the long-leaf pine region the remaining 31 per cent. (of which 28 per cent., referred to the total production of the state, is long staple, and 3 per cent. short staple); while the four counties forming the lower extremity of the peninsula, together with Franklin, constituting the pitch-pine, treeless, and alluvial region, produce practically none.

To keep distinct the relations between the short- and long-staple product, the yield of Liberty, Calhoun, Holmes, Washington, Walton, Santa Rosa, and Escambia, which belong to the long-leaf pine region, should be included with that of the five upland counties above named, since only the short-staple cotton is produced there in any large quantity. The upland areas, as thus extended, yield 72 per cent. of the whole cotton crop, all of which is short-staple cotton; and the remaining counties of the state produce almost exclusively sea-island cotton, which forms 28 per cent. of the entire crop.

To go more into detail, the upland counties proper, with an area of 3,850 square miles, have 18 per cent., or 443,211 acres, in cultivation, of which 35 per cent. is in cotton, while the long-leaf pine region, with eight times the area, or 30,830 square miles, has only 2.2 per cent., or 434,826 acres in cultivation, and only 21 per cent. of this in cotton.

These comparisons show more strikingly the relations of the two regions to the cotton production of the state.

Leaving out of account, as before, the eight counties which produce less than 100 bales each, but which have large towns within their limits, it is seen that the seven counties above named as producing 72 per cent. of the cotton of the long-leaf pine region have a population of 64,927, or considerably over half that of the twenty-one cotton-producing counties. In these seven counties the proportion of white to colored is as 1 to 0.96, the two classes being about equal in number. On the other hand, in the fourteen counties which produce 4,456 bales, or only about 26 per cent. of the crop, the whites outnumber the blacks in the proportion of 39,661 to 11,114, or nearly 3.6 to 1.

Of the seven principal (sea island) cotton-producing counties of the pine region the product per acre shows an almost uniform increase going southward, Levy standing highest and Columbia lowest. Their ranks in the proportions of cotton acreage to the inhabitant, cotton acreage to the square mile, and population to the square mile, on the contrary, are almost directly proportional to their degree of proximity to the upland region. This uniformity is interrupted in each case by a single county. Thus the large population to the square mile of Alachua county (13.07) places it at the head of the list, instead of in its proper place geographically; and to its large population is probably also due its exceptional rank (between Columbia and Suwannee counties) in cotton acreage to the square mile.

In cotton acreage to the inhabitant Marion county is eccentric, standing between Suwannee and Columbus.

FERTILIZERS.—It may be inferred from the reports which have come from some of the counties, and it is also clearly shown in the low product per acre of the principal cotton-producing counties, that the use of fertilizers is not general in Florida. It is only in those counties whose total product is a few bales, or, in other words, where cotton is cultivated only in small patches for home use, that a high yield is noticed (except in the case of Levy county, already referred to). Cotton-seed meal, barn-yard compost, and guano appear to be used in small quantities in many parts of the state, but such a thing as systematic application of manure to the fields is essentially unknown.

Marls.—Samples of marl from various parts of the state have come under notice, and a few analyses have been made.

Marl from Wakulla county.

Insoluble residue	35.555	39.011
Soluble silica	3.456	
Potash		0.372
Soda		0.338
Lime		30.986
Magnesia		0.424
Manganese (brown oxide)		0.134
Peroxide of iron		0.534
Alumina		1.196
Phosphoric acid		0.014
Sulphuric acid		0.331
Carbonic acid		24.253
Water and volatile matter		3.074
Total		100.667

This is the marl which gives to the Gulf hummocks of Wakulla county their exceptional fertility.

A marl from the vicinity of Live Oak was analyzed with the following result:

Marl from Live Oak, Suwannee county.

Insoluble residue	1.070
Lime	56.634
Carbonic acid	42.146
Iron and alumina	0.123
Phosphoric acid	0.200
Total	100.173

This is almost pure carbonate of lime, and hardly a marl, strictly speaking, but well adapted to use as such.

Specimens of marl from various localities in Clay county have been received, but have not been analyzed.

In many counties, especially southward, and in the near vicinity of rivers and other water-courses, are great heaps of the shells of recent fresh-water species; and these have been used to a limited extent.

In Volusia county a very friable shell-marl, apparently not of living species, has been dug and applied to the fields in certain localities. Indeed, from the very nature of the geological formation which makes the substratum of the entire state, it seems almost certain that calcareous material suitable for agricultural purposes will be found in most of the counties.

Phosphatic rock.—Among the samples of building-stone sent to Dr. George W. Hawes, of the National Museum, was one from Hawthorne, in Alachua county. Upon analysis this rock was found to be rich in phosphoric acid, which led to the examination of a number of specimens. One of the analyses gave only 3 to 4 per cent. of phosphoric acid; another as much as 16 per cent.; and I have taken the following analysis as representing probably the average composition of the material:

Phosphatic rock from Hawthorne, Alachua county.

Insoluble matter	50 73
Potash	0. 33
Soda	0. 32
Lime	12. 01
Magnesia	0. 34
Peroxide of iron	1. 83
Alumina	12. 85
Phosphoric acid	13. 09
Carbonic acid	0. 86
Water and volatile matter	8. 39
Total	100. 75

Of the extent of this deposit little is as yet definitely known beyond the fact that specimens were collected from localities at least a mile apart. This occurrence of phosphatic rock will probably be thoroughly investigated and utilized.

Marsh muck.—Of this substance I have nothing to say from personal knowledge, but from the statements of Williams and others it appears that it has been tried in many instances, especially on the eastern side of the peninsula, and has been found to be a valuable fertilizer for the sandy pine lands.

Since marsh muck is humus, resulting from the partial decay of vegetable matter in marshes and bogs, the beneficial effects of its application to the sandy soils of the peninsula are two-fold: physically, it improves the sandy soil by making it more coherent, and on account of its capacity for absorption of water it increases its moisture; and chemically, since the muck holds all the mineral substances contained in the plants from which it was derived, and as its organic acids fix the ammonia resulting from the decomposition of the nitrogenous parts of the plants, it may be looked upon as a complete manure, furnishing directly all those ingredients which the growing crop can assimilate from the soil. Its acidity should, wherever possible, be counteracted by the simultaneous use of marl or lime.

Of the great quantity and easy accessibility of marsh muck in most parts of Florida there can be no doubt; the humus from bogs and swamps inland might be profitably used in the same way as marsh muck.

Table of analyses of Florida soils, marls, etc.

No.	Name.	Locality.	County.	Depth in inch.	Vegetation.	Insoluble matter.	Silica soluble in Na_2CO_3.	Total insoluble residue and soluble silica.	Potash.	Soda.	Lime.	Magnesia.	Brown oxide of manganese.	Peroxide of iron.	Alumina.	Phosphoric acid.	Sulphuric acid.	Carbonic acid.	Water and organic matter.	Total.	Hygroscopic moisture.	Temperature of absorption (C°).	Analyst.
	SOILS.																						
	Oak, hickory, and pine lands.																						
1	Red loam soil.....	Spring creek, near Campbellton.	Jackson..	10	Hickory, sweet-gum, post, red, and Spanish oaks, and short-leaf pine.	84.240	3.250	87.490	0.072	0.016	0.266	0.105	0.077	1.456	6.885	0.222	0.033	.....	4.053	100.678	4.291	21.8	Cory.
2	Upland brown loam soil.	Six miles northeast of Tallahassee.	Leon.....	9	Post, red, and Spanish oaks, hickory, sweet-gum, short-leaf pine; long moss on trees.	86.460	2.640	89.100	0.065	0.013	0.243	0.023	0.024	1.491	3.977	0.323	0.011	.....	3.982	99.252	4.159	21.1	Do.
8	Table-land soil.....	Mount Pleasant.....	Gadsden..	9	Long-leaf pine, black-jack, red, and post oaks, and some hickories; wire-grass and oak-runners.	93.362	1.721	95.083	0.045	0.018	0.064	0.005	0.220	0.941	1.339	0.066	0.091	.....	2.422	100.294	1.830	21.1	McCalley.
	Long-leaf pine region.																						
6	First-class oak, hickory, and pine land soils.	Nine miles north of Ocala.	Marion...	10	Long-leaf pine, red oak, and hickory.	94.460	1.665	96.125	0.189	0.038	0.072	0.039	0.055	0.321	0.915	0.110	0.091	.....	1.884	99.839	2.188	26.1	Durrett.
7	Second-class gray sandy pine-land soils.	Five miles north of Lake City.	Columbia.	10	Long-leaf pine, with wire-grass undergrowth.	95.630	0.879	96.509	0.117	0.004	0.058	0.042	0.049	0.224	0.473	0.092	0.058	.....	1.807	99.493	1.643	24.5	Do.
5	Dark-gray (high) hummock soil.	One mile south of Ocala.	Marion...	10	Live, water, and white oaks, hickories, magnolia, bay, sweet and sour gums.	90.585	1.380	91.965	0.112	0.035	0.185	0.033	0.027	2.048	2.494	0.110	0.054	.....	3.583	100.646	4.210	26.6	Do.
4	Light (low) hummock soil.	Leesburg.....	Sumter...	8	Hickory, live and water oaks, red bay, evergreen.	97.350	0.214	97.564	0.052	0.015	0.077	0.019	0.032	0.214	0.628	0.079	0.053	.....	1.675	100.408	1.199	23.8	Do.
	MARLS.																						
3	Marl from Gulf hummock.	Six miles north of Saint Mark's.	Wakulla..	.....	.....	35.555	3.456	39.011	0.372	0.338	30.986	0.424	0.134	0.534	1.196	0.014	0.331	24.253	3.074	100.667	.....	.....	McCalley.
	Marl from Live Oak..	.....	Suwannee.	.....	.....	.....	.....	1.070	.....	.....	56.634	.....	.....	0.123		0.200	.....	42.146	.....	100.173	.....	.....	Loughridge.
	Phosphatic rock, mean of two analyses.	Hawthorne.....	Alachua..	.....	.....	50.730	.....	.....	0.330	0.320	12.010	0.340	.....	1.830	12.850	13.090	.....	0.860	8.390	100.750	.....	.....	Dr. George W. Hawes.
	Phosphatic rock.....	.....do.....	....do	.....	.....	46.830	.....	.....	.....	.....	2.750	0.270	.....	1.640	19.610	16.020	.....	.....	14.280	101.400	.....	.....	Do.

PART II.

AGRICULTURAL DESCRIPTION OF THE COUNTIES OF FLORIDA.

LIST (WITH BOTANICAL NAMES) OF THE MOST COMMON TIMBER TREES, SHRUBS, AND WEEDS OCCURRING IN FLORIDA.

This list is intended to include only the more common trees and shrubs, most of which are mentioned in county descriptions.

Some of the more common herbaceous plants have already been mentioned above in the general description and their botanical names given.

In the elevated and bottom lands of the upland region:

Quercus falcata, Mx. Spanish oak, red oak.
Quercus tinctoria, Bastr. Black oak.
Quercus coccinea, Wang. Scarlet oak.
Quercus rubra, L. Red oak.
Quercus obtusiloba, Mx. Post oak.
Quercus alba, L. White oak.
Quercus aquatica, Catesb. Water oak.
Quercus nigra, L. Black-jack.
Quercus Phellos, L. Willow oak.
Pinus mitis, Michx. Short-leaf pine.
Pinus Tæda, L. Old-field pine.
Pinus glabra, Walt. Spruce pine.
Juglans nigra, L. Black walnut.
Carya tomentosa, Nutt. Hickory.
Magnolia grandiflora, L. Magnolia.
Magnolia Fraseri, Walt. Large-leaf magnolia.
Liriodendron tulipifera, L. Poplar.
Cornus Florida, L. Dogwood.
Diospyros Virginiana, L. Persimmon.
Liquidambar styraciflua, L. Sweet-gum.
Nyssa multiflora. Wang. Sour-gum.
Fagus ferruginea. Ait. Beech.
Platanus occidentalis, L. Sycamore.
Ulmus Americana, L. Elm.
Asimina triloba, Dunal. Papaw.
Asimina pygmæa, Dunal. Dwarf papaw.
Oxydendrum arboreum, DC. Sour-wood.

The trees and shrubs of the hummocks are, to a great extent, the same as those of the bottom lands of the upland region; but the following are more characteristic of the hummocks:

Quercus virens, Ait. Live oak.
Persea Carolinensis, Nees. Red bay.
Sabal palmetto, R. S. Cabbage palmetto, along the coast.
Juniperus Virginiana, L. Red cedar.
Fraxinus Americana, L. White ash.

Many of the trees above named are also found along the borders of swamps; but the following are more characteristic of swamps:

Taxodium distichum, Rich. Cypress.
Fraxinus platycarpa, Michx. Water ash.
Nyssa uniflora, Walt. Tupelo.
Quercus lyrata, Walt. Over-cup oak.
Prinus, L. Swamp chestnut-oak.
Magnolia glauca, L. Bay.
Cephalanthus occidentalis, L. Button bush.
Enonymus Americanus. L. American strawberry bush.
Cliftonia ligustrina, Banks. Titi.

In the pine region the more common trees and shrubs are:

Pinus australis, Michx. Long-leaf pine, yellow pine.
Pinus Cubensis, Grisebach. Pitch pine, along the coasts and in the lowlands south of latitude 27°.
Quercus cinerea, Michx. High-ground willow oak.

In the sterile pine lands other species of oaks have a dwarfed or scrubby growth.

Carya tomentosa. Hickory; also often assumes a shrubby growth on pine barrens.
Sabal serrulata, R. S. Saw palmetto.
Sabal Adansonii, Guerns. Dwarf palmetto. These two grow commonly on low sandy pine lands.
Zamia integrifolia, Wild. Coontie. Low grounds of southern Florida.
Kalmia latifolia, L Calico bush.
Kalmia hirsuta, Walt. Wicky-flat barrens.
Prinos glabra, L. Gallberry. Flat pine barrens.

The following list embraces the plants most troublesome as weeds:

Cassia obtusifolia, L.
Cassia occidentalis, L.
Cassia Marilandica, L.
Cassia Chamæcrista, L.
Cassia nictitans, L., var. *aspera*.

These cassias have the general name of coffee-weeds or coffee-plants. The most common and troublesome as weeds are perhaps *obtusifolia* and *Chamæcrista*.

Richardsonia scabra. Florida clover, Indian clover, beggar-lice, and so on. This plant grows everywhere in sandy fields. By some it is considered very good pasturage, and therefore is not an unmitigated evil.
Ambrosia artemisiæfolia, L. Hog-weed.
Xanthium strumarium, L. Cocklebur.
Helenium tenuifolium, Nutt. Yellow dog-fennel; a most troublesome weed. It is eaten in the spring by cattle, and imparts an intensely bitter taste to the milk.
Maruta Cotula, DC. Dog-fennel, May-weed. Formerly more troublesome; now being driven out by *Helenium tenuifolium*.
Bidens frondosa, L. Beggar-ticks.
Bidens bipinnata, L. Spanish needles.
Amarantus spinosus, L. Careless-weed.
Chenopodium Anthelminticum, L. Worm-seed, Jerusalem oak.
Dactyloctenium Ægyptiacum, Willd. Crow-foot grass.
Panicum sanguinale, L. Crab-grass.
Cenchrus echinatus, L. Sand spur, cockspur.

AGRICULTURAL DESCRIPTION

OF THE

COUNTIES OF FLORIDA.

The counties are here grouped under the heads of the several agricultural regions, previously described, to which each predominantly belongs. Each county is described as a whole. When its territory is covered in part by several adjacent soil regions, its name will be found under each of the several regional heads in which it is concerned, with a reference to the one under which it is actually described. In the lists of counties placed at the head of each group the names of those described *elsewhere* are marked with an asterisk (*); and the reference to the head under which these are described will be found in its place, in the order of the list, in the text itself.

The regional groups of counties are placed in the same order as that in which the regional descriptions themselves are given.

The statements of areas, woodland, prairie, and so on, refer to the original state of things, irrespective of tilled or otherwise improved lands.

Appended to the description of each county from which a report or reports have been received is an abstract of the main points of such reports, so far as they refer to natural features, production, and communication. Those portions of the reports referring to agricultural and commercial practice are placed in a separate division (Part III), following that of the county descriptions.

In making abstracts of the reports it has been necessary, in most cases, to change somewhat the language of the reporter, while preserving the sense.

I.—OAK, HICKORY, AND PINE UPLAND REGION.

The following counties lie wholly or partly within this region: In western Florida, Walton,* Washington,* Calhoun,* and Jackson; in middle Florida, Gadsden, Liberty,* Leon, Jefferson, and Madison.

WALTON.

(See under "Long-leaf pine region".)

WASHINGTON.

(See under "Long-leaf pine region".)

CALHOUN.

(See under "Long-leaf pine region".)

JACKSON.

Population: 14,372.—White, 5,637; colored, 8,735.

Area: 1,000 square miles.—Woodland, all. Red lime-lands, 150 square miles; oak and hickory uplands, including pine ridge lands, 400 square miles; long-leaf pine lands, 450 square miles.

Tilled lands: 84,738 acres.—Area planted in cotton, 26,920 acres; in corn, 33,780 acres; in oats, 6,174 acres; in rice, 88 acres; in sweet potatoes, 1,622 acres; in sugar-cane, 566 acres.

Cotton production: 6,144 bales; average cotton product per acre, 0.23 bale (short staple), 324 pounds seed-cotton, or 108 pounds cotton lint. Thirty-two per cent. of the tilled lands are devoted to cotton culture.

The whole of Jackson county is underlaid by limestone, upon the eroded surface of which have been subsequently deposited thick beds of sand, pebbles, and red or yellow loam. Frequently the upper beds of these drifted materials are mostly sand, and when that is the case, as in the western or northwestern part of the county, where denudation has been least effective, high, rolling land prevails, with sandy soil, and universally clothed with a growth of the long-leaf pine.

The Chipola river and its tributaries traverse the county from north to south near its center, and in its drainage area the sands have been to great extent removed, in some cases laying bare the limestone itself. Along this river a strip of country 20 or 30 miles long and perhaps 10 miles wide has a rich loamy soil, thoroughly marled and rendered fertile by the calcareous matter of the country rock. This is known in the county as red lime-land. Upon these red lands white orbitoides limestone (Vicksburg) was observed in several outcrops, usually a little above the general level of the red fields. The area occupied by this kind of land is perhaps about one-sixth of the county lying adjacent to the Chipola river and its tributaries.

Between the Chipola and the Chattahoochee rivers the original thickness of sands and clays remains in great measure, forming high pine barrens, where, in many places, the only associate of the long-leaf pine is a dwarf oak. Toward the Chipola, where the limestone is near or at the surface, the big spring of Chipola, between Marianna and Chattahoochee, breaks up from the foot of a bluff of this rock some 20 feet high and runs off in a large stream.

Near the southern limit of the county, and reaching down into Calhoun, the oak uplands, with brown loam soil and red clay loam subsoil, which form so large a part of the uplands of Leon and Gadsden counties, are met with on the western side of the river. These uplands extend across the county to Washington, where they subside as detached hills.

It will be seen that Jackson county possesses a large area of excellent farming lands, which may be described under the heads of—

1. Red lime-lands of the Chipola and its tributaries.
2. Brown loam uplands, with red clayey subsoil, timbered chiefly with oaks and hickories. To these may be added:
3. The long-leaf pine ridge lands and rolling pine lands, which are of less value agriculturally.

Of these soil varieties the brown loam and the pine ridge lands are commonly found in the other upland counties, but the red lime-lands have not been met with in any large bodies outside of Jackson county.

ABSTRACT OF REPORT OF JAMES V. BURKE, OF MARIANNA.

This report refers to the lowlands of the Chipola river, a tributary of the Chattahoochee, and to the high rolling and level lands between the Chipola and the Chattahoochee, and westward of the Chipola. The soils described are those enumerated above.

Red lime-land.—This has a brown or reddish loam soil with a red clayey subsoil (sometimes bluish), with limestone underlying at 3 to 8 feet below the surface. It supports a growth of several species of oak, hickory, beech, poplar, and dogwood, with short-leaf pine where the soil is a little sandy. Though productive, it is not easy to till, as it is very sticky in wet weather and hard in dry seasons. Most of this land is cleared and cultivated. The usual crops are produced, but cotton (short staple) upon at least one-half of the land. The stalks vary in height from 2 to 10 feet, according to locality, being about equally productive at all heights. From fresh land the yield is 1,000 to 2,000 pounds of seed-cotton to the acre, and 1,425 to 1,650 pounds are required to make a 475-pound bale. After ten years' cultivation the average yield is said to be from 800 to 1,500 pounds. Cotton from this land rates from good ordinary to low middling, and from the cultivated land it is usually one grade better, owing to the fact that less cotton rots in the boll because of smaller weed. Much of this land, about one-sixth, now lies turned out. When taken again into cultivation it is usually not much improved, for it supports, when not cultivated for two or three years, a dense growth of broom-sedge, which keeps it pretty well drained of available plant-food. On account of the generally level character and the tolerably stiff soil of the red land there is not much damage done by washes or gullies. In cases, however, where horizontalizing and hillside ditching are practiced the damage from this cause is almost completely checked. The injury to the valleys from washing is due to the fact that they are covered with a coarse gravelly sand.

Next in importance to the red lime-lands are the oak and hickory or brown loam uplands, which have as subsoil the yellowish or red loam alluded to above. In places in this county pebbles also are found intermixed with the other materials constituting the subsoil. The usual growth is very similar to that upon the limestone lands, with perhaps a larger percentage of short-leaf pine. The soil is a fine sandy loam of a grayish to brown color, easily tilled in all seasons, and is well suited to all the southern crops, although about one-half the area is planted in cotton. The usual height of stalk is from 2 to 3 feet.

On fresh land the seed-cotton product is 1,000 pounds to the acre, and about 1,200 to 1,300 pounds are required to make a 400-pound bale. The staple is classed as low middling. Under cultivation the land deteriorates, so that after five years, without manuring, the seed-cotton product per acre is only 500 pounds, of which 1,365 to 1,425 pounds are needed to make a 475-pound bale. The fiber is said to improve slightly as the land deteriorates. Of this land very little now lies turned out, and that which has rested and been taken again into cultivation is much improved, being nearly as productive as the fresh land. From the uneven character of the surface, gullies and washes are numerous, and the valleys are injured to the extent of 25 to 50 per cent. by the washings from the uplands. Hillside ditching and horizontalizing, when carefully carried out, are found to be effective remedies against this evil.

The long-leaf pine ridge lands occupy at least one-third of the area, predominating in the western parts of the county and toward the south. The natural growth is long-leaf pine, with scrub oaks, with which are associated trees of black-jack and other species of oak and hickory where this soil variety approaches the others above described. The three principal types of soil herein mentioned grade off into each other where they come in contact. The soil is a coarse sandy, sometimes gravelly, material, of a whitish or gray color. These characters are frequently maintained without serious change to a depth of 3 to 5 feet, and below this there is often a heavy, close sand, not very pervious to water. Pebbles also are occasionally found in the subsoil. In these pine lands limestone lies deep below the surface. From its nature this soil is best suited to sugar-cane, ground-peas, and sweet potatoes, though with the use of fertilizers cotton may very profitably be cultivated. Very little cotton, however, is produced upon it.

The fresh land, unmanured, will yield from 300 to 700 pounds of seed-cotton to the acre, and the staple is rated as good. The stalk is low, from 2 to 2½ feet in height, and never runs to weed. Under cultivation this soil is naturally soon exhausted, yielding on an average after five years (unmanured) 300 pounds of seed-cotton, the staple of which, however, is by some thought to rate better than that from the fresh land. Where such lands lie well they are coming into notice, because of the ease with which they are cultivated and their safety, and from the fact that with small outlay for commercial fertilizers good returns are obtained.

Upon the red lime-lands the natural tendency of the cotton-plant is to go to weed, particularly in wet seasons; on the loam lands it rarely goes to weed, and on the pine ridge lands never. Any tendency in this direction may usually be checked by the application of phosphates at the rate of 100 pounds to the acre. This stimulates the plant to early fruiting, and will increase the yield 25 to 50 per cent. The most troublesome weeds upon all classes of soil are crab-grass, crow-foot grass, coffee-weeds, and cockleburs.

Shipments of cotton are made from September 10 to January 1, by steamer or by rail, to Columbus and Savannah, Georgia. The rate of freight per bale is 75 cents to Columbus and $2 25 to Savannah.

GADSDEN.

Population: 12,169.—White, 4,114; colored, 8,055.

Area: 540 square miles.—Woodland, all. Oak and hickory uplands, 180 square miles; long leaf pine ridge lands, 235 square miles; hummocks, 125 square miles.

Tilled lands: 65,304 acres.—Area planted in cotton, 19,464 acres; in corn, 25,753 acres; in oats, 2,853 acres; in rice, 139 acres; in sweet potatoes, 898 acres; in sugar-cane, 443 acres.

Cotton production: 4,696 bales; average cotton product per acre 0.24 bale (short staple chiefly), 345 pounds seed-cotton, or 115 pounds cotton lint.

Throughout Gadsden county the country rock is a white limestone of Tertiary (Eocene) age.

In the upper part of the county, from Chattahoochee to Quincy, there is a belt of high table-land, the elevation of which above sea-level cannot be less than 300 feet. Northward toward the Georgia line, upon the drainage slope of Flint river, this table-land breaks off into brown loam uplands, and lower down into rolling pine lands.

The distribution of the soil varieties is to a great extent determined by the position of the water-courses. Upon the high plateau above mentioned, and in general upon the ridges separating adjacent drainage basins, the soil is quite sandy, and the timber chiefly long-leaf pine, associated in places with black-jack and other species of oak, with some hickories. In the poorer spots the growth, both of pines and oaks, is stunted. An undergrowth of wire-grass is found throughout this area, which occupies about one-third of the county.

The sandy soil is underlaid at varying depths by a reddish clayey loam, which, as we descend from the table-lands toward the water-courses, itself forms the surface (the overlying sandier portions having been washed away), and constitutes the red and brown loam uplands. These cover, perhaps, another third of the county. As is usual wherever the red and brown loams form the surface materials, covering the underlying country rocks in considerable thickness, the surface is generally quite broken.

At still lower levels, where the loams forming the soils and subsoils of the uplands have been mostly removed by denudation and only comparatively thin deposits of sandy material have been left upon the country limestone, the gently undulating or rolling country is timbered mostly with large pines. Not much of Gadsden county is of this kind, but the loam uplands, as a rule, reach down to the vicinity of the water-level in the various streams, where the hummocks, (*a*) both clay and sandy, or, more properly speaking, the second bottoms, begin.

Upon the table-lands first mentioned the cultivation of the sea-island cotton is reaching considerable proportions. Upon the other varieties of soil the upland cotton is almost exclusively cultivated.

ABSTRACT OF REPORT OF JESSE WOOD, OF MOUNT PLEASANT.

This report refers to the lowlands of Mosquito and Flat creeks, tributary to the Apalachicola river, and to the highlands between Chattahoochee and Quincy.

The soils described are: 1st, those of the table-land; 2d, of the oak and hickory uplands; 3d, clay hummocks; 4th, sandy hummocks.

The table-lands, or pine ridge lands, are cultivated in cotton, corn, oats, tobacco, sugar-cane, and potatoes. The soil is sandy, and the growth long-leaf pine, with some oak. Of late years the cultivation of grapes has become a very important item. The use of fertilizers in cotton-planting on this land is becoming general, none being produced without them. With fertilizers this is considered very safe for cotton, which is now cultivated on about one-third of the cleared land. Under favorable circumstances the yield is 700 to 800 pounds of seed-cotton to the acre, the staple being rated as "low middling". Very little if any of the table-land now lies turned out, and on account of its position there is no injury from washing or gullies.

The soil next in importance, or probably of equal importance, is that of the red clay or loam uplands, occupying one-third of the area of the county. This soil supports a natural growth, which varies with the soil itself. Where this is sandy, long-leaf pine is the chief timber tree, but with increasing proportions of loam or clay oaks and hickory and short-leaf pine replace partly or altogether the long-leaf species. Below the red clay or loam, which is of varying thickness, are found beds of sand and occasionally of pebbles, especially westward within the drainage area of the Apalachicola river, and underneath all the limestone, which, however, does not usually appear at the surface except in the vicinity of the river. This soil is good for all the ordinary crops, but is considered best adapted to cotton (short staple), which is cultivated on perhaps one-third of the cleared land. The height of the stalk when most productive is 4 feet, and on fresh land, according to its quality, a yield of from 800 to 1,000 pounds of seed-cotton to the acre may be expected. The staple is rated as "low middling". This soil retains well its fertility, yielding 500 to 700 pounds of seed-cotton to the acre after ten years' cultivation without manure. With long-continued cultivation of the land the staple is slightly deteriorated. Unlike the table-lands, these uplands suffer from washing, but the lowlands are usually improved rather than injured by washings from high levels. This trouble can be successfully remedied by hillside ditching and horizontalizing. One-fourth of the land originally cultivated now lies turned out, and when again taken into cultivation it produces nearly as well as when fresh, especially when cattle have not been allowed to graze upon it.

The clay hummocks are situated, as above indicated, near the creeks, and they constitute perhaps one-sixth of the tillable area of the county. The natural growth is beech, white oak, hickory, magnolia, spruce pine, etc. The color is usually what is known as mulatto, and the depth of soil to where change of color is noticed is from 5 to 6 inches. The subsoil is a clay or loam, sometimes red, sometimes yellow, sometimes what is called pipe-clay. This soil, as well as that of the red clay uplands, is easily tilled, except in dry weather, when the ground is likely to become too hard. It is neither early nor late, warm nor cold, but of medium quality. The three staple crops—corn, cotton, and oats—are cultivated, the soil being apparently best adapted to cotton, which is planted on about three-fourths of the cleared

a It will be seen that in the brown loam region the term hummock is usually applied to the lowlands in the vicinity of water-courses or lakes, though sometimes also to the uplands which bear a growth of oaks and hickories. In this respect the custom here differs from that prevailing in some parts of the peninsula, where the term hummock lands is almost invariably applied to places where the underlying limestone mingles with and marls the usually sandy surface soil.

land. The usual height of stalk at which it is most productive is from 4 to 6 feet, and the seed-cotton product on fresh land under favorable circumstances is from 800 to 1,200 pounds. The staple rates as "low middling". Like that of the red clay uplands, this soil retains well its fertility, yielding after ten years' cultivation, without manure, 600 to 800 pounds of seed-cotton, according to quality; and, as is usually the case, the staple is slightly deteriorated. From its position this class of land is much injured by gullies, the valleys being, on the other hand, if anything, improved by washings from the uplands. Horizontalizing and hillside ditching are practiced to some extent, and, when properly done, check the damage from washing. About one-half of this land lies turned out. It recovers rapidly when cattle are kept off, and when again taken into cultivation produces nearly as well as fresh land.

Closely associated with the above, and occupying similar positions along the banks of creeks, are the sandy hummocks. The natural growth upon these is the same as that upon the clay hummocks, with the addition of willow oak. The subsoil, as well as the soil, is more or less sandy. This soil is warm, early, well-drained, and easily cultivated, producing well the three staple crops, but being best adapted to corn, since cotton is much more likely to go to weed upon this than upon the other soils above described. In extent the sandy hummocks are about like the clay hummocks, embracing one-sixth of the cultivated lands. Only about one-third is planted in cotton, which grows well when the land is fresh, but soon falls off with continued cultivation. The staple is usually rated as "low middling", but it is inferior to that of cotton grown upon the other varieties of soil. The fresh land yields 800 to 1,200 pounds of seed-cotton to the acre, but after some years' cultivation not more than 300 or 400 pounds are produced. The staple from the old land is very much inferior to that from the fresh. Probably one-half of the sandy hummock land originally cultivated now lies turned out, but it is quite productive when reclaimed, provided that cattle have not been allowed to graze upon it. As to injury from washing and remedy for the evil, what has been said above under clay hummocks applies equally here.

In all these soils late planting and wet seasons are looked upon as producing a tendency to run to weed, and early planting and topping are suggested as remedies. Crab-grass is by far the most troublesome weed.

Shipments of cotton are made from September 1 to March, by rail and water, to Savannah, Columbus, and to New Orleans. The usual rate of freight to Savannah, to which port most of the cotton goes, is 75 cents per hundred pounds.

LIBERTY.

(See under "Long-leaf pine region").

LEON.

Population: 19,662.—White, 2,822; colored, 16,840.

Area: 900 square miles.—Woodland, all. Oak and hickory uplands (including long-leaf pine ridge lands about 200 square miles), 400 square miles; first-class pine lands, 275 square miles; second- and third-class pine lands, 225 square miles.

Tilled lands: 104,857 acres.—Area planted in cotton, 42,988 acres; in corn, 43,745 acres; in oats, 3,193 acres; in rice, 41 acres; in sweet potatoes, 2,024 acres; in sugar-cane, 844 acres.

Cotton production: 9,562 bales; average cotton product per acre, 0.22 bale (short staple), 318 pounds seed-cotton, or 106 pounds cotton lint.

In geological structure Leon county resembles Gadsden. As compared with Gadsden, it has a rather more broken and uneven surface, and the level table-lands are here almost wanting.

In its general appearance the country about Tallahassee northward is the counterpart of much of the oak uplands of Georgia, Alabama, and Mississippi. A few miles southward of the capital, however, there is a descent into the low, flat pine woods, which, interspersed with hummocks and swamps, reach to the Gulf.

Of the soil varieties of Leon county three only need special mention: 1st, the red or brown clay loam lands, sometimes called oak and hickory hummocks; 2d, the light sandy pine lands; and, intermediate between these, 3d. A light clay loam of grayish color, with a growth chiefly of pine, forming the long-leaf pine uplands or ridge lands.

The most important soil is that of the red or brown clay loam lands, which form about one-half the cultivated area of the county. The principal trees are species of oak, with hickory and short-leaf pine. Near the lakes other hard woods are associated with these. This soil is a clay loam of gray, brown, and mulatto colors, changing at an average depth of 6 inches to the subsoil, which is heavier, more clayey, and of a dark red color on the better lands and yellow in the poorer spots. Underneath this are beds of sand and gravel 25 to 50 feet in depth, resting upon a substratum of limestone, which, however, is rarely seen except in the southern parts of the county. As usual where the drift beds overlying the limestone are very thick the inequalities produced by sinks in the latter rock are shown on the surface as large depressions filled with water, constituting lakes and ponds. In this way the region characterized by lime-sinks differs from that in which lakes are the distinctive features, the country rock being in the latter case deeply covered with drifted or transported materials, which in the former case have been partially removed by denudation, leaving the limestone bare, or, at most, covered by only a few feet thickness of sand or loam.

The upland pine woods or pine ridge lands are next in importance to the loam uplands. The soil, which is of a gray to mahogany color, rests upon a subsoil of somewhat heavier material, often a red clay loam, quite hard, and sometimes of a yellow color. Beneath this is a joint clay at depths of 8 to 15 feet.

ABSTRACT OF REPORT OF JOHN BRADFORD, OF TALLAHASSEE.

The red or brown loam soil and that of the pine ridge lands are both easily tilled, early, and warm, and are well adapted to corn, cotton, etc.; but about one-half the cleared land in both cases is in cotton, which attains a height of 3 to 4 feet, being most productive at 3 feet. When left too thick, and when the seed is not frequently changed, the plant shows a tendency to run to weed, which tendency may be checked by allowing proper distance between the plants, by bringing in new seed from the upcountry (Georgia and South Carolina) and sometimes by topping.

The seed-cotton product upon the fresh land (red clay loam uplands) is 1,000 to 1,500 pounds (after twenty years' cultivation, unmanured, 400 to 600 pounds); on the pine lands, from 800 to 1,000 (after fifteen years, unmanured, 600 to 800 pounds); and from 1,545 to 1,780 pounds in either case are needed to make a 475-pound bale. Crab-grass everywhere, and beggar-weed in some places, are the most troublesome weeds.

From 10 to 15 per cent. of the land now lies turned out, but the soils are rapidly recuperated after a few years' rest, when grazing is not allowed upon them. When taken again into cultivation they yield well the first year and better the second.

Except upon the flat or nearly level highlands considerable injury is done by washes and gullies, but the lowlands are frequently improved. To check this removal of soil from the uplands horizontalizing and hillside ditching have been tried with good success.

The third variety of soil, constituting what is known as the sandy pine lands (second and third classes), is of very little importance in cotton cultivation. It is found in spots all over the county, making nearly one-fourth of the area. The natural growth is almost exclusively long-leaf pine. The soil is light sandy, of a whitish gray color, and 5 to 6 inches deep to where the change of color is noticed. The subsoil is usually slightly heavier than the surface soil, being a yellowish-colored sand, underlaid with sand for several feet. It is easily tilled, but in places is boggy in wet seasons. No cotton is planted with profit upon this soil, which is best suited to sweet potatoes. This soil does not wash so readily as those having more clay in their composition, probably for the reason that the water is rapidly absorbed and does not collect and run off on the surface. The washings from the sandy uplands injure the lowlands by covering them with sand. The poor quality of the soil makes it scarcely worth while to practice horizontalizing or hillside ditching.

Cotton is shipped as fast as baled, by rail and steamer, to New York. The freight is about $1 20 per hundred to that port.

JEFFERSON.

Population: 16,065.—White, 3,397; colored, 12,668.

Area: 560 square miles.—Woodland, 520 square miles; oak uplands, 200 square miles; long-leaf pine uplands, 150 square miles; flat pine lands, 100 square miles; swamp and hummock lands, 70 square miles; coast marshes, 40 square miles.

Tilled lands: 104,350 acres.—Area planted in cotton, 37,500 acres; in corn, 39,059 acres; in oats, 3,949 acres; in rice, 22 acres; in sweet potatoes, 987 acres; in sugar-cane, 537 acres.

Cotton production: 10,368 bales; average cotton product per acre, 0.28 bale (short staple chiefly), 399 pounds seed-cotton, or 133 pounds cotton lint.

Jefferson county embraces every variety of soil, from the oak uplands to the coast flats.

From the Georgia line southward for 20 miles or more the face of the country is broken and hilly. The soil on these uplands varies from a light sandy to a dark stiff loam, and the subsoil in most cases is a pretty stiff red clay loam, which, however, at times, is too far below the surface to exercise an appreciable effect upon the soil. In such cases the growth is pine and black-jack; but where the soil becomes stiffer other trees, oaks and hickories chiefly, are added, and upon the best lands the oak and hickory growth prevails.

South of the uplands the country slopes gradually toward the Gulf. Some of this area is known as flatwoods, and on the borders of these lowlands and on some of the streams are the usual rich hummocks.

In the northern part of the county the thick beds of red sand and loam hide completely the underlying limestone, which extends, on the south, even several miles out to sea in very shoal water, the rock under this shoal water supporting a rich growth of aquatic grasses. The Massasaugea sinks are a few miles southeast of Micosakie lake, and into them the waters of the lake with several other streams discharge, and together plunge into the earth (Williams).

Between the uplands and the sea-shore intervenes a belt of flat lands, timbered with long-leaf pine and having a sandy soil. Where this soil is marled by mingling with the disintegrated calcareous rock it acquires a high degree of fertility and supports a growth of oaks and other hard woods. These places are called Gulf hummocks.

In places the limestone occasionally appears in outcrops, either through the sandy soils or around the edges of big springs or in the banks of streams.

ABSTRACT OF REPORTS OF JAMES F. TUCKER, OF MONTICELLO, AND J. P. GRANTHAM, OF WAUKEENAH.

These reports relate to the country drained by the Aucilla river, and describe soils of the pine ridge lands, oak and hickory uplands, hummocks, and flatwoods, or third-class pine lands. Of these the most important is the soil of the oak and hickory uplands, closely associated with which are the gray hummock lands. The latter, though of no great extent superficially, are thought to yield more cotton to the acre than any other kind. These two varieties make up probably three-fourths of the cultivated land in the northern part of the county, but a smaller portion farther south, where the pine lands prevail. The natural growth is hickory, species of oak, and short-leaf pine chiefly, with ash, beech, holly, red bay, gum, dogwood, and other trees in different localities. The lighter soils are fine sandy loams; the heavier, stiff clay loams, of a variety of colors, from white or gray, through yellowish, mulatto, orange, and brown, to nearly black. Between 2 and 6 inches a change of color is generally seen. The subsoil is usually a stiff red clay, inclined to hard-pan, standing well both wet and dry weather. In other cases the subsoil is lighter, soft, and easily worked. It contains frequently beds of rounded quartz pebbles, and where this is the case commercial fertilizers do well. Beneath the subsoil, at varying depths, from 10 to 100 feet, is found the limestone of the country. These soils are usually easily tilled, but the stiffer varieties are occasionally a little difficult of cultivation in wet seasons. They appear to be equally well suited to all the southern crops. Cotton, however, is planted upon at least 60 per cent of the cultivated loam lands, the chief drawback being the caterpillar, which invariably makes its appearance. The stalk attains a height of from 2 to 6 feet (on stronger lands still greater), being most productive at 5 feet.

The causes which tend to make the plant run to weed on these and the following soils are rich and fresh land, wet seasons, too heavy application of manures, and the attacks of the boll-worm, when they cause shedding of the fruit. Topping in July, light cultivation, and dry weather restrain this tendency and favor bolling, and allowing plenty of room will also act favorably in this respect. An average of 1,500 pounds of seed-cotton per acre is usually taken as the yield of the fresh land when the damage from caterpillars is insignificant. It requires about 1,660 pounds of seed-cotton for a 475-pound bale, and the staple (short) rates from middling to middling fair. After six

to ten years' cultivation without fertilizers the yield will be from 500 to 1,000 pounds, according to season and proportion of injury done by caterpillars. The staple on old land is not so good as that from fresh, rating as low middling or good ordinary. If well handled, however, there is not much difference in the staples from new and from old lands.

These lands suffer much from washes and gullies. The injury to the valleys from washings of the uplands varies greatly, and in some instances the soil appears to be lost entirely, and sand covers the bottoms, much to their detriment. In other cases the bottoms receive the cream of the upland soils, which are, *pari passu*, injured. Horizontalizing and hillside ditching are both practiced, usually the former, and, where properly done, with a fair degree of success.

The long-leaf pine lands occupy probably three-quarters of the entire county. The areas held by these lands may be subdivided into the pine uplands, or ridge lands, and the flatwoods.

Upland pine woods (ridge lands) occur in irregular bodies over all the county, except toward the coast, and occupy, in general terms, the higher lands, separating areas of oak uplands. The natural growth is long-leaf pine, with scrub oak occasionally, and with wire-grass below. Associated with these in low places are cypress, etc. The surface soil is sandy, coarse or fine, and generally of a whitish or grayish color. This material is often 1 to 3 feet in depth, and below it there is frequently a red or yellow clay, mixed with sand, and sometimes with gravel. Beneath this, at varying depths, occurs the limestone.

On these lands cotton forms perhaps two-fifths of the cultivated crops, the stalk attaining a height, when most productive, of 3 feet. On fresh land from 600 to 1,000 pounds of seed-cotton per acre may be obtained, the sample rating as middling and low middling. After six years' cultivation without manure the yield falls to 300 or 400 pounds with slightly deteriorated staple. About 1,660 pounds of seed-cotton are required in either case for a 475-pound bale. Much of these uplands suffer from washes, and usually the valleys are greatly injured by the sands which are washed down upon them. Where horizontalizing and hillside ditching are properly practiced, this evil may be in a great measure counteracted.

The flatwoods, as the name indicates, are level or gently undulating lands, supporting a growth of long-leaf pine, black-jack, scrub oak, saw palmetto, etc. The soil is sandy, of gray, brown, and mahogany colors, here and there alternating with white sand. There is often no change in the character of the material until the universally underlying limestone is reached. It is easily tilled, except when covered with water in wet seasons, and in this area are found all varieties of early, late, warm, and cold soils, according to locality.

The flatwoods are the natural pastures and timber lands, much of their area being occupied by cattlemen for a short time and then abandoned. Sea-island cotton is planted over a small proportion of the flatwoods, and in some places also the upland variety. The fresh land will produce sometimes 300 or 400 pounds of seed-cotton to the acre, but it is not profitably cultivated without manure for any great length of time. The staple from this land rates about middling; that from long cultivated land is not so good. There is no injury from washes, as the land is flat. Very little of the land formerly cultivated in the oak uplands, pine lands, or flatwoods lies turned out, less now than formerly.

All these soils, when allowed to rest, recuperate rapidly. It is necessary, however, to keep cattle off while the land is lying out, or it will deteriorate still further. Crab-grass, sand spurs, beggar-lice, coffee-weeds, and cockleburs are everywhere most troublesome weeds.

Cotton is shipped as fast as ginned, from October to January, by rail, usually to Savannah, Georgia. The rate of freight is 75 cents per hundred pounds, or $3 50 to $4 a bale.

MADISON.

Population: 14,798.—White, 5,609; colored, 9,189.

Area: 850 square miles.—Woodland, all. Oak uplands, 250 square miles; swamp and hummock lands, 175 square miles; pine lands, 425 square miles.

Tilled lands: 83,962 acres.—Area planted in cotton, 28,982 acres; in corn, 33,493 acres; in oats, 5,894 acres; in rice, 77 acres; in sweet potatoes, 889 acres; in sugar-cane, 573 acres.

Cotton production: 7,054 bales; average cotton product per acre, 0.24 bale (short staple chiefly), 348 pounds seed-cotton, or 116 pounds cotton lint.

The general topographical features of Madison county may be presented in a few words. Its western boundary is the Aucilla river; the eastern is formed by the Withlacoochee and Suwannee rivers. The highest land east and west lies, therefore, between these two drainage slopes, and there is also a gradual descent from the Georgia line southward. On the east the Withlacoochee and Suwannee rivers have cut through the surface materials down into the underlying limestones. On the west the thick beds of drift and loam have not been so deeply eroded by the Aucilla, and the indications of limestone are less apparent there. Between these two borders lie the undulating uplands.

The common classification of lands in Madison county is into pine lands, hummocks, and swamp, with intermediate varieties; and the distribution in general is: in the north and east, pine lands; south and west, hummocks.

The oak uplands, with red loam subsoil, which form so conspicuous a feature of the northern parts of Leon and Jefferson counties, occupy the western half of Madison county; thence eastward to the Withlacoochee and Suwannee rivers, and beyond into the western part of Hamilton and northwestern part of Suwannee county, the surface soil is more sandy, and the prevailing timber is long-leaf pine. Much of these high pine lands with sandy subsoils has a substratum of red or yellow clay loam, and therefore belongs to the class of pine uplands or ridge lands always associated with the oak lands.

Upon the red uplands the short-staple cotton is generally cultivated, as it is also to a great extent upon the upland pine lands; but the sea-island variety also succeeds well upon the latter.

South of the limit of the red or brown loam the land is generally rather low and flat, with a growth of pine and scrub oak, and in places of gallberry bushes. These lands constitute the flatwoods, which, for reasons already given, are seldom brought into cultivation.

Beginning in the lower part of Madison county and extending to the Gulf is an extensive and as yet unutilized area of almost impenetrable swamp land.

There is no prairie or savanna land in the county. For corresponding soils the abstracts given under Jefferson, on the one hand, and Hamilton, on the other, will convey a fairly correct idea of the capabilities of the soils of Madison.

Shipments from Madison are generally to Savannah, Georgia, at about 75 cents per hundred pounds.

II. LONG-LEAF PINE REGION.

Comprising, in western Florida: Parts of Escambia, Santa Rosa, Walton, Washington, Holmes, Jackson,* and Calhoun. In middle and eastern Florida: Parts of Liberty, Wakulla, Leon,* Jefferson,* Madison,* Taylor, all of Suwannee, parts of Hamilton, Columbia, Baker, Bradford, Nassau, Duval, Saint John's, and Clay. On the peninsula: Part of Putnam, all of Alachua, parts of Lafayette and Levy, all of Marion, parts of Volusia and Orange, all of Sumter, and parts of Hernando, Hillsborough, Polk, and Brevard.*

ESCAMBIA.

Population: 12,156.—White, 6,854; colored, 5,302.

Area: 720 square miles.—Woodland, all. Pine lands, 560 square miles, of which about 150 square miles are pine flats; swamp lands, 75 square miles; pitch-pine flats, 85 square miles.

Tilled lands: 1,298 acres.—Area planted in cotton, 25 acres; in corn, 602 acres; in oats, 132 acres; in rice, 68 acres; in sweet potatoes, 164 acres; in sugar-cane, 12 acres.

Cotton production: 10 bales; average cotton product per acre, 0.40 bale (short staple), 570 pounds seed-cotton, or 190 pounds cotton lint.

The surface soil in Escambia county is generally sandy, with a substratum of clay of various colors—white, yellow, red, and blue. Near the Escambia river there are many occurrences of a dark-brown ferruginous sandstone, formed by the drift sand, cemented by iron. The soil being generally siliceous, supports a growth of long-leaf pine chiefly, with wire-grass. Near the streams are occasionally productive hummocks. Between Pensacola bay and Santa Rosa sound the peninsula is said to have a stratum of peat beneath the surface sands, and in this peat abundant cypress and cedar stumps (Williams' *View of West Florida*, 1827, p. 7). The clays are worked into excellent bricks.

In its surface configuration this county shows a general slope from north to south, and from the center toward the Perdido river on the west and toward the Escambia on the east. These highlands are timbered with pine, and form good grazing grounds. The northern part is uneven and in places hilly, the sandy soil resting upon red clay subsoil.

Cotton is generally shipped via Pensacola to New Orleans, 75 cents a bale being the usual rate of freight.

SANTA ROSA.

Population: 6,645.—White, 4,773; colored, 1,872.

Area: 1,260 square miles.—Woodland, all. Pine lands, 1,060 square miles, of which about 210 square miles are pine flats; swamp lands, 160 square miles; coast lands, 40 square miles.

Tilled lands: 1,804 acres.—Area planted in cotton, 17 acres; in corn, 1,135 acres; in oats, 60 acres; in rice, 169 acres; in sweet potatoes, 158 acres; in sugar-cane, 43 acres.

Cotton production: 5 bales; average cotton product per acre, 0.29 bale (short staple), 420 pounds seed-cotton, or 140 pounds cotton lint.

Between the Escambia and Blackwater rivers is a tract of land with a sandy clay subsoil, known as Pine Level, which is perhaps one of the best parts of Santa Rosa county agriculturally, since most of the southern crops do well upon it. Between Blackwater and Yellow Water rivers are pine ridges, with sandy soil, usually rather poor.

The peninsula between Escambia bay and Yellow Water bay is generally covered with pine and black-jack oaks, with some moist savannas and a few hummocks (Williams). The same character of land is found on the peninsula between Pensacola bay and Santa Rosa sound.

The bottom lands of the Escambia river are said to be quite rich, but being subject to overflow are not much in cultivation. Along Pensacola bay and the other bays with which this county is indented are many spots of good hummock land.

The soil on the uplands is mostly sandy, and of gray mulatto and brownish colors. The subsoil is in many instances sandy also, but occasionally is of reddish or yellowish clay.

Beside the extensive pine uplands there are numerous gallberry flats and titi swamps.

The bottoms of the Blackwater and the Yellow Water rivers afford a grayish sandy soil.

In surface configuration Santa Rosa county shows a general slope southward from the Alabama line, the uplands being sandy, with long-leaf pine. Very little cotton is planted in the county, as the soil is better adapted to other crops, such as corn, rice, sugar-cane, and particularly to sweet potatoes. The principal occupation of the inhabitants is the cutting and shipping of pine timber.

ABSTRACT FROM REPORT OF DR. JOHN M. M'GEHEE, OF MILTON.

The soil is at all times easy of cultivation, early, warm, and well drained. The cotton stalk is most productive at a height of about 3 feet, but shows a tendency to run to weed in wet seasons and when growing on loose soil. Application of manure stimulates the plant to early fruiting and prevents running to weed. The seed-cotton product per acre of the fresh land is from 400 to 600 pounds, about 1,780 pounds being needed to make a 475-pound bale. Cotton has been cultivated in this county too short a time to furnish other data of importance. Florida clover is considered the most troublesome weed. When lands are reclaimed after lying turned out for three or four years they are about as productive as when fresh, especially where cattle have not been allowed to graze upon them. From the general character of the soil, its porous, absorbent nature, and the favorable, nearly level position of the lands, comparatively little injury is experienced from washes and gullies.

Shipments of cotton are made via Pensacola by steamer or sail-boat to New Orleans, and the usual rate of freight is 75 cents a bale.

WALTON.

Population: 4,201.—White, 3,685; colored, 516.

Area: 1,360 square miles.—Woodland, all. Oak uplands, 75 square miles; pine lands, 1,110 square miles, which 250 square miles are pine flats; marshes, 100 square miles; swamp, 75 square miles.

Tilled lands: 9,373 acres.—Area planted in cotton, 1,437 acres; in corn, 6,025 acres; in oats, 1,091 acres; rice, 120 acres; in sweet potatoes, 304 acres; in sugar-cane, 153 acres.

Cotton production: 382 bales; average cotton product per acre, 0.27 bale (short staple), 378 pounds seed-cott or 126 pounds cotton lint.

A line of sand-hills running approximately east and west, though near the center of Walton county, divid the waters which flow southward into Choctawhatchee bay from those which fall into Shoal creek on the nor This ridge is more than 30 miles long, is generally sandy, and the ferruginous sandstone of the stratified dr covers many of its high points. Toward the north and south its sides are steep and cut up into deep ravine toward the west it slopes off gradually into low pine barrens; toward the east, however, it subsides in a seri of detached peaks or hills, among which are the headwaters of Shoal, Alaqua, and Euchee creeks (William Northwest of these hills the country is generally undulating, with sandy soil, and is covered with a growth long-leaf pine and wire-grass, rising gradually toward the Alabama line.

Along Yellow Water creek, near the northern part of the county, are tracts of very good land, not confin to the immediate vicinity of the river, but extending out for several miles.

The sand-hills above mentioned may be looked upon as marking nearly the southern limit of the high lan for below them the country slopes off gradually toward the Gulf.

Limestone appears to underlie the whole county, but it comes to light only near the eastern edge, where has been laid bare by the waters of White creek, and in the Euchee valley; but the presence of this rock elsewhe is suggested by the circumstance that Alaqua, Twin, Boggy, and Rock creeks, which rise at the foot of the san hills above named, receive the waters and increase their volumes rapidly from several large springs, "some which are large enough to turn mills at their source" (Williams' *View of West Florida*, 1827, p. 21).

Upon the substratum of limestone there have been deposited beds of sand and loam, which increase in thickne toward the Alabama line. The upper beds are usually more or less sandy, and where these are thickest t country presents the usual characters of the pine barrens, viz, open pine woods, with ponds and lakes interspers McDavid's lake, or Lake View, as it is now called, one of the largest of these bodies of water, lies partly in th county and partly in Alabama, and is 3 miles long by 1½ miles wide. The land on its borders has a clayey subs and produces well. Pond creek connects this lake with Shoal creek and Yellow Water river.

In the sand-hill region below Shoal creek there are also several ponds of considerable size, situated in the op pine woods. In all this part of the county the drainage has not cut down through the sand, but eastward a southward the waters flowing into Choctawhatchee river and bay have removed much of the superficial sands a brought to light the underlying red loams, and in some cases the limestone itself.

Along Alaqua creek there are areas of hilly country with a fertile soil and a red clay subsoil. Similar tracts a found in the Euchee valley. This land seems in many respects to resemble the red lands of Jackson county, whi have resulted from the intermixture of the limestone or marl with the loamy surface soil.

The presence of lime in the subsoil and in the substratum of rock underlying the eastern part of this a the western part of Washington county is sufficiently well indicated in the prevalence of spruce pine in t bottoms near the Choctawhatchee river and in the abundance of fresh-water shells in most of the streams.

Near the Choctawhatchee river, southeast of Euchee Anna, in the Mushy bend, the land has a heavy, loa soil, with a red clay subsoil, and in places a marl beneath. This river has in this county a wide bottom or swa which is very rich and productive, but is not much cultivated because of its liability to be overflowed. West of t bend above named is a comparatively high, sandy country, very poor, but covered with a dense carpet of wire-gra and therefore an excellent grazing region during the summer time.

In the southern part of the county, near Choctawhatchee bay, are several large swamps. Toward the co the soil is sandy and barren.

As a general summary it may be asserted that about one-third of the county is good tillable upland a hummock, the rest being the poorer qualities of pine lands, barrens, and swamp.

Cotton is shipped from some parts of the county by water to New Orleans; from other parts by rail to N Orleans and other markets.

WASHINGTON.

Population: 4,089.—White, 3,171; colored, 918.

Area: 1,330 square miles.—Woodland, all. Pine lands, 950 square miles, of which 250 square miles are pi flats; oak uplands, 50 square miles; swamp hummock and coast lands, 330 square miles.

Tilled lands: 12,063 acres.—Area planted in cotton, 1,877 acres; in corn, 5,809 acres; in oats, 565 acres; rice, 84 acres; in sweet potatoes, 325 acres; in sugar-cane, 131 acres.

Cotton production: 602 bales; average cotton product per acre, 0.32 bale (short staple), 456 pounds seed-cott or 152 pounds cotton lint.

The greater part of Washington county is made up of pine lands, yet all gradations between the fertile r clay or loamy soils and those of the pine barrens are met with.

The brown or red loam uplands, which constitute the fine farming lands of southern Georgia and Alaban terminate north of the center of this county in a series of hills elevated some hundred feet or more above t contiguous country. These hills, the best known of which are Orange hill, Oak hill, Mossy hill, and Wind hi have each a fertile soil resting upon a stiff red clay subsoil, and support a native growth, consisting of hickory a varieties of oak chiefly, with which are associated short-leaf pine. From the sides of these hills rise numero springs, which constitute the headwaters of Hard Labor and Dry creeks and the Econfina river. These hills a separated from each other by valleys of sterile pine lands and gallberry flats.

CALHOUN.

Population: 1,580.—White, 1,184; colored, 396.

Area: 1,160 square miles.—Woodland, 980 square miles; pine lands, 775 square miles; swamp lands, 170 square miles; oak and hickory uplands, 35 square miles; marsh, 180 square miles.

Tilled lands: 3,453 acres.—Area planted in cotton, 721 acres; in corn, 1,643 acres; in oats, 391 acres; in rice, 75 acres; in sweet potatoes, 173 acres; in sugar-cane, 52 acres.

Cotton production: 172 bales; average cotton product per acre, 0.24 bale (short staple), 339 pounds seed-cotton, or 113 pounds cotton lint.

The northern part of Calhoun county is hilly and broken, the southern low and flat, and limestone underlies the whole area at varying depths. Upon the divides, especially in the northern half of the county, the limestone is covered to a great depth beneath the drifted materials, and here we find the usual ponds and lakes. Near the water-courses the sands have been more or less completely removed, leaving the underlying formation near the surface, giving occasion to the occurrence of lime-sinks and big springs. The banks of the Apalachicola river in Calhoun county as far south as Iola are in great part bluffs of this limestone, which is in places a good shell marl, suitable for fertilizing purposes.

West of Iola are the Dead lakes, sunken areas with dead cypress forests standing submerged to depths of 10 to 20 feet. This would indicate that the sinking which formed the basins of the lakes is of comparatively recent date, and it is generally thought that subsidence is still in progress, from the fact that a young growth of cypress is gradually spreading outward from the margins of the lakes.

South and west of the Dead lakes Calhoun county is low, flat, and marshy or swampy, the pine flats being overgrown chiefly with the Cuban or pitch pine.

The red clay hills which mark the southern limit of the uplands in this, as in Washington county, are found as far south as the base-line running east and west through Tallahassee.

In the character of soil and production of cotton Jackson county, elsewhere described, especially in its northern parts, has much in common with this county.

The Apalachicola river is the only way of outlet for the products of Calhoun county.

LIBERTY.

Population: 1,362.—White, 814; colored, 548.

Area: 800 square miles.—Woodland, all. Oak uplands, 200 square miles; pine lands, 315 square miles; flatwoods, 250 square miles; swamps, 35 square miles.

Tilled lands: 3,630 acres.—Area planted in cotton, 734 acres; in corn, 2,202 acres; in oats, 621 acres; in rice, 71 acres; in sweet potatoes, 128 acres; in sugar-cane, 59 acres.

Cotton production: 197 bales; average cotton product per acre, 0.27 bale (short staple chiefly), 381 pounds seed-cotton, or 127 pounds cotton lint.

The sandy table-lands of Gadsden county, with their growth of long-leaf pine and wire-grass, extend southward into Liberty county for some distance, gradually merging, below the central part of the county, into an almost uninhabited region some 20 to 30 miles square. This section is interspersed with ponds, fringed with almost impenetrable shrubbery, and the flatwoods between the little creeks are covered with saw palmetto, wire-grass, and other grasses, which furnish the best pasturage for cattle.

Bordering upon the Apalachicola river is a strip with a red clay subsoil, but back a short distance from the river are high lands, on which the sand covers deeply the red clay.

Marl beds, which are outcrops of the underlying limestone, make their appearance at the surface wherever the drainage has cut deep enough. This occurs in many places near the Apalachicola river, and also in the eastern part of the county, near the Ocklockonnee river, while between the two wells sunk to a depth of 15 to 20 feet below the surface nearly always reach a marl.

Occasional small limestone springs break up from the ground, but the underlying rock, especially in the northern part of the county, and in parts of Gadsden also, appears to be rather compact; a white, amorphous, earthy, calcareous mass, which breaks with conchoidal fracture, and being of quite uniform texture, is not readily worn into caverns and inequalities by the solvent action of the waters. In the southern part of the county it seems probable that the limestone is of a different nature, more like that which is seen near the coast in Wakulla county eastward.

The description of Gadsden county, where the characters of the soil and varieties common to the two counties are given, will supply further details.

The Apalachicola river and the Jacksonville, Pensacola and Mobile railroad are the two principal routes by which shipments of cotton are made.

WAKULLA.

Population: 2,723.—White, 1,563; colored, 1,160.

Area: 580 square miles.—Woodland, 480 square miles; coast marshes, 100 square miles; pine lands, 380 square miles; swamps and hummocks, 100 square miles.

Tilled lands: 13,678 acres.—Area planted in cotton, 2,311 acres; in corn, 6,871 acres; in oats, 554 acres; in rice, 37 acres; in sweet potatoes, 134 acres; in sugar-cane, 108 acres.

Cotton production: 561 bales; average cotton product per acre, 0.24 bale (chiefly long staple), 340 pounds seed-cotton, or 85 pounds cotton lint.

Wakulla county lies entirely upon what we have called above the Gulf slope. Its surface rises gradually toward the north, being nowhere very much elevated above tide, and, while generally level, there is still sufficient inequality of surface to secure thorough drainage.

The limestone in this county is always near the surface, and although the soil is in great measure composed of sand, yet, by reason of intermixtures with the marl or disintegrated limestone, it shows all grades of fertility, from sandy pine barrens to the richest hummocks.

underlaid at varying depths of from 5 to 10 feet by the limestone, which is usually rather soft. This land is sometimes a little difficult to cultivate in wet seasons, but it is usually quite easy. In this vicinity corn, sugar-cane, sea-island cotton, oats, peanuts, peas, and sweet potatoes are the usual crops. This soil is best suited to cotton, oats, and potatoes; 10 per cent. of the cultivated land being in cotton, which attains a height of 6 or 8 feet, being most productive at 6. The fresh land will produce 500 pounds of seed-cotton to the acre, 1,575 pounds being required to make a 350-pound bale, and sells at 35 cents a pound. After three years' cultivation (unmanured) the yield is 400 pounds, of same quality and about the same yield of lint.

2d. *High-hummock land.*—About 15 per cent. of the uplands, or 30 per cent. of the whole area, is of this kind. The natural growth consists of species of oak, hickory, magnolia, bay, sweet bay, cabbage palmetto, pine, cedar, elm, linden, etc. The soil is a fine sandy loam, of brown, reddish, and blackish colors, varying in thickness from 8 to 12 inches. The subsoil varies, being sometimes sand, but most of these lands are underlaid either with marl or lime-rock at different depths. The subsoil often contains fragments of the limestone inclosing sea-shells. The cultivation is usually easy; the soil is better adapted to corn and sugar-cane, only 2 or 3 per cent. being planted in cotton, which attains a height, when most productive, of about 4 feet. The fresh land will sometimes yield 400 pounds of seed-cotton, falling to 300 pounds after three years' cultivation. From 1,665 on fresh to 1,750 pounds on long-cultivated land are required to make a 350-pound bale, and the usual price is 34 cents a pound; on old land the staple is slightly inferior.

3d. *Black-jack ridges or sandy pine lands.*—This variety makes about 30 per cent. of the whole area, or 15 per cent. of the uplands. The natural growth is long-leaf pine, black-jack oak, and wire-grass. The soil is fine and sandy, of a gray to whitish color, changing at 3 to 4 inches depth to a lighter sand, sometimes yellow, sometimes white, which constitutes the subsoil. In these areas the lime rock lies deep below the surface, and is seldom reached. The soil is best adapted to peas, peanuts, and sweet potatoes, and not more than 2 to 3 per cent. is planted in cotton. The stalk grows to the height of 2½ feet. Two hundred pounds per acre is the average seed-cotton product on fresh land, and 1,750 pounds are required to make a 350-pound bale, and sells at 35 cents a pound. After three years' cultivation without manure the yield is 100 pounds an acre. When the cotton is planted late or upon fresh land it often shows a tendency to run to weed. Application of stimulant manures and topping are the usual remedies. Upon all these soils crab and crow-foot grasses and sand spurs give most trouble to the farmer. None of these lands originally cultivated now lie turned out, and by reason of their generally level position there is no injury from washing and gullies.

Cotton is hauled from the different parts of the county to stations on the Jacksonville, Pensacola and Mobile railroad and sold to merchants; by them it is shipped thence by rail to Savannah, at the rate of about $3 per bale. Most of the shipments are made in December.

SUWANNEE.

Population: 7,161.—White, 4,021; colored, 3,140.

Area: 660 square miles.—Woodland, all. Pine lands, including barrens or flatwoods, 630 square miles; swamp lands, 30 square miles.

Tilled land: 37,590 acres.—Area planted in cotton, 7,288 acres; in corn, 12,410 acres; in oats, 2,132 acres; in rice, 154 acres; in sweet potatoes, 484 acres; in sugar-cane, 238 acres.

Cotton production: 1,177 bales; average cotton product per acre, 0.16 bale (sea island), 228 pounds seed-cotton (sea island), or 57 pounds cotton lint.

The highest land in Suwannee county is in the eastern central part, from which the drainage slopes incline toward the north, west, and south, the Suwannee, or one of its main branches, the Santa Fé, receiving all the waters.

This county shares with Hamilton and Madison, in part, the clay subsoil. The surface is diversified, being chiefly rolling pine lands, interspersed with low pine lands and palmetto and gallberry flats, called here "flatwoods". Near the Suwannee and other streams occasional hummocks are found.

The Suwannee river flows, in a part of its course, between banks of lime rock, and large springs break out in several places from its crevices.

Limestone is the underlying rock through the whole county, and exhibits several varieties, some of which are soft and easily cut when freshly quarried, and, as it hardens on exposure, it is used in some localities for building purposes. It is laid bare in many places where most of the superficial sands have been removed by denudation, especially near the Suwannee river.

ABSTRACT OF REPORTS FROM L. A. JENNINGS, OF LIVE OAK, AND GEORGE E. DEXTER, OF HOUSTON.

The soils may be divided into the following well-marked varieties, viz: 1st. Rolling or level pine uplands, with clay subsoil (first class); 2d. Gray or gravelly lands; 3d. Sandy pine lands (second class); and subordinated to these, 4th. Swamp and hummock lands, together with third-class pine lands and flatwoods.

1st. *Rolling pine uplands.*—This class of soil forms about one-third of the county, the prevailing growth being long-leaf pine, with oak and hickory added upon the uplands. The soil is as usual a sandy loam of whitish or gray-reddish to brown colors, underlaid with a sandy clay, occasionally with tough dark-colored clay, which is hard while the land is resting, but mellow after being broken up. This subsoil often contains concretions of bog-iron ore, and rests usually upon the limestone rock at depths of 5 to 8 feet. This land is of easy cultivation under nearly all circumstances. The soil is apparently best adapted to cotton (long staple), potatoes, and rice. One-half to three-quarters of the tillable land is put in cotton, which grows to a height of 4 to 9 feet, being most productive at about 4 feet. On the black pine lands, on fresh land, and when the seasons are too wet, the plant tends to run to weed. When this is the case, topping and late plowing are resorted to as remedies. The yield of seed-cotton per acre (sea island) on fresh land is put at about 500 pounds, about 1,315 pounds being required to make a 350-pound bale. The staple is rated as medium to good. After five to ten years' cultivation without manure the yield decreases from 250 to 400 pounds, according to quality of soil, it being in some localities much stronger than in others. The staple is then, perhaps, a little coarser, but not much different, and about the same quantity of seed-cotton is needed for a bale. Very little, if any, of this land has been abandoned. When the "turned-out" land has been reclaimed, it is said to yield at its best. Upon the rolling lands there is occasionally some injury from washes; on the more level areas, none.

2d. *Gray or gravelly lands.*—These make up two-fifths of the cultivated land in the vicinity of Houston, at least for 15 miles in each direction. The natural growth is hickory and white oak. The soil is coarse sandy, mixed with gravel, and is of gray to nearly black colors. The subsoil is somewhat heavier, containing coarse gravel and fragments of rock (probably limestone, perhaps flint), and is underlaid at 4 to 8 feet depth by the limestone rock of the country. Land of this kind is easily tilled, and the soil is warm, early, and well drained, being very well suited to the cultivation of sea-island cotton, which is the chief crop. The height attained by the stalk is 3 to 7

feet, it being most productive at 3 to 5 feet, and upon this soil it is never known to run to weed. The average seed-cotton product per acre on fresh land is given at 600 pounds, 1,300 or 1,400 pounds being required to make a 350-pound bale, the staple rating as good. After ten years' cultivation without manure the yield keeps up to 500 pounds, requiring 1,490 pounds of seed-cotton for a bale, the staple being very little, if at all, different from that of fresh land. With such exceptional strength it is not surprising that none of these lands have been turned out.

3d. *Second-class pine lands.*—These constitute perhaps one-sixth of the cultivated lands about Live Oak. The growth is almost exclusively long-leaf pine. The soil, fine and coarse sandy, is of usually light colors, sometimes inclined to reddish, and from 1 inch to 6 inches depth before its color changes to that of the subsoil. The subsoil is generally heavier than the soil, being a sandy clay, resting usually upon sand, the underlying rock being seldom seen. The land is, of course, always of easy tillage, and is warm and well drained. The usual crops are cotton, peas, and fruit—mostly grapes and oranges. Three-fourths of the land is put in cotton (long staple), which has an average height of 2½ to 3 feet, being most productive at 3 feet. It has no tendency to run to weed. Fresh land will yield 300 pounds of seed-cotton to the acre of medium staple, 1,050 pounds being required for a bale. Five years' cultivation without manures will bring down the yield to 150 pounds, but with no material difference in the ratio of lint or the quality of the fiber. Upon all the soils crab-grass, sand spurs, and hogweed give most trouble. There is no injury from washes on this and the preceding soil, since the surface is nearly level.

A third class of pine barrens (including "flatwoods") is prevalent in some parts of the county, but is comparatively little in cultivation; and a so-called black hummock land, timbered with bay, magnolia, white oak, ash, gum, etc., is cultivated in corn and rice, but not in cotton. This soil is a dark-gray to black, resting upon a tough black clay, which is easily worked after being once broken up. It contains fragments of the lime rock with which it is underlaid at a depth of 5 to 8 feet. In wet weather it is rather difficult to cultivate, but it is of easy cultivation in dry seasons.

Shipments of cotton are made from November to January by rail to Charleston, South Carolina, and Savannah, Georgia. The rate is 75 cents per hundred pounds.

HAMILTON.

Population: 6,790.—White, 4,472; colored, 2,318.

Area: 540 square miles.—Woodland, all. Pine lands, 340 square miles; swamp lands, 125 square miles; hummocks, 75 square miles.

Tilled lands: 39,731 acres.—Area planted in cotton, 11,680 acres; in corn, 14,991 acres; in oats, 2,570 acres; in rice, 225 acres; in sweet potatoes, 379 acres; in sugar-cane, 222 acres.

Cotton production: 1,908 bales; average cotton product per acre, 0.16 bale (chiefly sea island), 228 pounds seed-cotton, or 57 pounds cotton lint.

The surface of Hamilton county, though in general somewhat rolling, is in good part, especially in the northeast quarter, occupied by what are known as flatwoods or pine barrens.

The general drainage is southward from the Georgia line into the Suwannee river and its tributaries. The highest lands are west of the center of the county, and near the White Sulphur springs, in the southeast corner, adjacent to the Suwannee river.

Near the rivers which bound the county the drainage has cut down into the subjacent limestone, and occasional outcroppings of this rock may also be noticed 5 or 6 miles distant from these streams.

In many parts of the county a red or a yellow clay loam underlies the soil at varying depths, and while this county might, on this account, be classed in the agricultural division of the brown loam uplands, the oak uplands, so characteristic of the counties farther west, are almost entirely lacking here. On the other hand, much of the pine land has a substratum of the clay loam, like the pine uplands of Jefferson county, etc.

The soil over a large proportion of the county is sandy and rather light, and the principal varieties recognized are: 1st, rolling uplands, with dark loamy soil, and sandy subsoil resting upon red or yellow clay loam; 2d, sandy uplands, including pine barrens and flatwoods, the last two being similar in quality; 3d, hummocks; and 4th, swamps.

Upon some of the uplands the short-staple cotton is planted; but sea-island cotton makes about five-sixths (or more) of the crop, according to estimates of correspondents.

ABSTRACT OF REPORTS OF THOMAS N. BELL AND H. J. STEWART, OF JASPER.

The reports refer to the region drained by the Alapaha and Suwannee, and the soils described are those above enumerated.

1st. Rolling uplands, with growth of long-leaf pine, interspersed with red oak, hickory, etc. In the most fertile portions the oak and hickory prevail to the almost total exclusion of the pine. In this the first-class pine lands approach in quality the oak uplands. It is estimated that about one-sixth of the county near the water-courses possesses soil of this nature. The uplands vary considerably. Some are level pine barrens, others rolling. These latter, especially when red oak and hickory grow upon them to any extent, are productive, the valleys in particular. The soil is sandy, and generally of light colors; subsoil, a yellow or red clay, which rests upon lime-rock at varying depths. This kind of soil is well adapted to the upland or short-staple cotton, which is planted on at least a third of the cultivated land. The stalk attains a height of 3 or 4 feet. The seed-cotton product on fresh land is from 500 to 1,000 pounds (the latter in the bottoms and valleys), and from 1,660 to 1,900 pounds are required to make a 475-pound bale. After five years or more of cultivation (unmanured) the yield is brought down to 300 pounds. The staple from this worn land is usually not much inferior to that grown on fresh land. Only a small proportion of this kind of land lies turned out. When reclaimed, it produces about as well as originally. There is not much injury done by washes, and the valleys are, if anything, considerably benefited by the settling from the slopes. Some slight efforts have been made to stop the washings by horizontalizing and hillside ditching, and with good success where properly done.

2d. Flatwoods, including some of the pine barrens. These level lands cover over one-half of the county, and they have a natural growth of yellow pine, with an undergrowth of saw palmetto. Cypress ponds and gallberry flats are interpersed throughout this area. The soil is a fine sand of a grayish color, 3 or 4 inches thick before change of color; the subsoil is heavier, is of a yellow color, passing into clay usually at 4 feet depth. Tilling qualities of the land, generally easy. The usual crops are cultivated, viz, sea-island cotton, sweet potatoes, oats, sugar-cane, etc., the soil being apparently best adapted to cotton, which is planted on about one-third of the tilled land. The stalk often grows to 6 feet height, but observation has shown that it is most productive at about 5. Three causes tend to make the cotton run to weed, viz., not thinning out at proper time, improper cultivation, and too much wet weather. When wet weather is the cause, topping is the remedy suggested; when improper cultivation is to blame, the remedy is obvious. "If the hands are idle, hire a new set, or discharge

and hire over the same set." Five hundred pounds is taken as the average seed-cotton product per acre on fresh land, and 300 pounds after ten years' cultivation without manure. There is a slight difference in the staple in favor of the fresh land. In both cases about 1,400 pounds are needed to make a 350-pound bale. The cleared land is generally under cultivation, and very little of it is turned out, and from its level nature there is hardly any tendency to wash or gully. Crab-grass, dog-fennel, hogweed, and beggar-lice or Indian clover are most troublesome weeds upon all the soils.

3d. Some good bodies of hummock swamp lands are found in various parts of the county.

Shipments of cotton are made from September on, mostly to Savannah, Georgia, by rail, at $1 per bale.

COLUMBIA.

Population: 9,589.—White, 4,820; colored, 4,769.

Area: 860 square miles.—Woodland, all. Pine lands (including flatwoods), 635 square miles; swamp lands, 150 square miles; hummocks, 75 square miles.

Tilled land: 45,759 acres.—Area planted in cotton, 13,142 acres; in corn, 18,685 acres; in oats, 4,616 acres; in rice, 317 acres; in sweet potatoes, 687 acres; in sugar-cane, 297 acres.

Cotton production: 1,992 bales; average cotton product per acre, 0.15 bale (sea island), 212 pounds (sea-island) seed-cotton, or 53 pounds cotton lint.

Columbia county is in great part upon the elevated belt forming the water-shed between the Atlantic and the Gulf. The county slopes away from the high land of the northeastern and eastern parts toward the Suwannee river on the west and toward Olustee creek and Santa Fé river on the south.

The soils throughout the county are sandy, with the exceptions noticed below, and are underlaid with either a reddish or a yellowish clay loam, or with sands, according to locality.

The prevailing growth is long-leaf pine, with the usual first, second, and third class pine lands.

In the northeastern and eastern portions of the county, upon the dividing ridge, there is much flat land of second and third quality, with pine, saw palmetto, and wire-grass as natural growth, with numerous tracts of swamp and many lakes. Such lands, though flat and often covered with water, are not unhealthy. Where the land is more rolling a yellowish sandy soil frequently occupies a position between the uplands and the lowlands corresponding to the oak uplands farther west.

In addition to the pine lands and swamps there is in this county a fair proportion of hummock land. Where the drainage has thinned down the covering sands in the vicinity of the various water-courses the hummocks are of frequent occurrence. These, however, are not always confined to the vicinity of streams, but appear occasionally in the highest parts of the county. Lake City is said to be about 200 feet above the Atlantic, and in its vicinity flat pine lands, interspersed with swamps and lakes, prevail. The analysis of soil from near Lake City will show the composition of the better class of flat pine lands.

ABSTRACT OF REPORTS OF MESSRS. G. B. SMITHSON, OF LAKE CITY, AND T. R. COLLINS, OF MIKESVILLE.

The soils described are those of the pine lands and of the hummocks.

1st. *Light rolling sandy pine lands.*—These make three-fourths of the uplands, the growth being chiefly long-leaf pine. The soil is a fine sandy loam, gravelly in spots, of whitish to yellowish colors, averaging in depth 6 to 8 inches. The subsoil is usually heavier than the soil, being upon the hills a reddish clay or stiff loam, which mixes with and stiffens the soil, making it more difficult to cultivate, as it hardens upon exposure to the sun. Beneath the subsoil, at depths varying from 2 to 10 feet, is usually found the limestone of the country. The soil is easily tilled, and is early, if well drained. The principal crops are corn, sea-island cotton, sugar-cane, oats, potatoes, etc. Cotton, oats, and peas succeed best, other crops usually requiring fertilizers for their successful cultivation. Cotton makes usually about one-third of the crop, the stalk attaining a height of 4 to 5 feet, being most productive at about 4. Upon fresh land the seed-cotton product per acre is 400 to 500 pounds (1,400 pounds to a 350-pound bale), the staple rating as fair. After four years' cultivation without manure the product falls to 350 pounds, with slightly reduced percentage of lint, which does not rate quite so well (by 1 cent to 3 cents per pound) as that produced upon fresh land, but comes a week or two earlier. Being light, this soil washes badly on slopes, but the valleys are usually benefited to the extent of 10 or 15 per cent. by the washings from the uplands. Scarcely any efforts have been made to check the damage, but when horizontalizing has been tried it succeeds well.

2d. *Yellow sandy soil,* a little broken and usually lying between the uplands and the lowlands. This soil (which seems to correspond to the oak and hickory uplands of the western counties of middle Florida) occurs in limited patches of 30 to 50 acres, and makes perhaps 10 to 15 per cent. of the lands near Mikesville. The growth is long-leaf pine, with an undergrowth of scrub oak and hickory. The color is yellowish, and the depth 6 to 8 inches. The subsoil is mostly clay, sometimes a variety of the country rock, which has a very small proportion of lime, but a correspondingly large percentage of siliceous matter, and which is usually called sandstone. The clay is usually at the depth of 2 feet. These soils are easily tilled in dry seasons, but difficult—becoming boggy from bad drainage—in wet weather. Corn, cotton (sea island), and oats are the chief products, cotton forming 10 or 15 per cent. of the whole. The stalk grows to a height of 4 or 5 feet, being most productive at 4. The fresh land will bring 400 pounds of seed-cotton (one-fourth lint by weight) to the acre. The staple is rated as fair in good seasons, but it is liable to be stained, and thus injured, if it falls upon the ground. The land retains its fertility well. Much injury is caused by washes and gullies, and the valleys suffer from the sands washed from the uplands; yet almost no efforts have been made to check the damage.

3d. *Dark hummock land.*—This forms only a small proportion (one-tenth or less) of the arable land, being in patches of a mile or two in area. The natural growth is hickory, oak, red bay, cherry, gum, and magnolia. The soil is a light clay loam of a blackish or dark brown color, 12 or 14 inches deep, with dark clay, or, in places, a red clay subsoil, containing fragments of limestone full of shells. Beneath these lie sand and limestone rock at 2 to 4 feet depth. The soil is heavily timbered and difficult to clear, but is of easy tillage. In wet seasons it is unfit for cotton on account of bad drainage, but is well adapted to corn and sugar-cane. Cotton forms not more than one-tenth of the cultivated crop. The stalk grows to 6 or 7 feet in height, but is more productive at about 5. The seed-cotton product on fresh land is 400 to 600 pounds per acre (one-fourth lint), which rates as fair, but which is usually slightly inferior to that grown upon the uplands. The soil shows very little evidence of exhaustion after several years' cultivation without manures. No injury from washes or gullies. When planted late or upon fresh land, when plowed deep, or when the season is too wet, the plant shows a tendency to run to weed. Topping or shallow culture are resorted to as remedies. The most troublesome weeds are crab-grass, sand spurs, Jerusalem oak, hogweed, and

On the islands of the coast, and on the mainland, the soil is well suited to the long-staple cotton, which, however, at present forms a very small percentage of the agricultural products of the county.

In addition to the sandy soils above mentioned, which have in cases a substratum of clay and sometimes of marl, thus giving rise to great variety, there are along the coast large bodies of marsh land, which have been partially reclaimed, but are now generally lying idle, and along the tributaries of the Nassau river tracts of swamp land, which are yet to be drained and generally brought into cultivation.

Sea-island or long-staple cotton is the variety produced.

Cotton is shipped from the different ports to Savannah and Charleston.

DUVAL.

Population: 19,431.—White, 8,580; colored, 10,851.

Area: 900 square miles.—Woodland, 825 square miles; coast marshes, 75 square miles; pine lands, chiefly flatwoods, 725 square miles; swamps and hummocks, 100 square miles.

Tilled lands: 5,959 acres.—Area planted in cotton, 57 acres; in corn, 1,939 acres; in oats, 46 acres; in rice, 92 acres; in sweet potatoes, 476 acres; in sugar-cane, 121 acres.

Cotton production: 23 bales; average cotton product per acre, 0.40 bale (sea island), 564 pounds seed-cotton, or 141 pounds cotton lint.

Duval county, like Nassau, is generally rather low, the eastern part being flat and marshy, the western consisting in great part of low pine barrens. The elevation above the sea of the western part is about 50 feet. The soil is light sandy, interspersed with a few areas of hummock land. This soil, though light, does well with the use of fertilizers, and marls are easily obtained in all parts of the county.

Near the Saint John's river and many of its tributaries are bodies of swamp land yet to be brought under cultivation.

Shipments of cotton are made by water to Savannah and Charleston principally.

SAINT JOHN'S.

Population: 4,535.—White, 3,170; colored, 1,365.

Area: 1,000 square miles.—Woodland, 860 square miles; coast marshes, 140 square miles; pine lands, chiefly flatwoods, 610 square miles; swamps and hummocks, 250 square miles.

Tilled lands: 2,841 acres.—Area planted in cotton, 8 acres; in corn, 1,282 acres; in oats, 52 acres; in rice, 16 acres; in sweet potatoes, 273 acres; in sugar-cane, 149 acres.

Cotton production: 6 bales; average cotton product per acre, 0.75 bale (sea island), 1,052 pounds seed-cotton, or 263 pounds cotton lint.

The general surface of Saint John's county is low, flat, and in great part occupied by "scrub" pine barrens, with palmetto undergrowth. North of Saint Augustine a ridge of pine land 3 or 4 miles wide, extending from the north line to Saint Augustine, separates two good bodies of land. Although the hummocks are not extensive, yet the pine land, 5 or 6 miles from the river, has a good clay foundation, and produces excellent crops (Williams).

The small streams which flow into the Saint John's river and the Atlantic ocean have usually very good hummocks.

Shipments from Saint John's county are by steamer or sail-boat to the northern markets.

CLAY.

Population: 2,838.—White, 2,265; colored, 573.

Area: 640 square miles.—Woodland, all. Pine lands, 550 square miles; swamp lands, 70 square miles; hummocks, 20 square miles.

Tilled lands: 4,069 acres.—Area planted in cotton, 456 acres; in corn, 1,885 acres; in oats, 214 acres; in rice, 45 acres; in sweet potatoes, 146 acres; in sugar-cane, 74 acres.

Cotton production: 96 bales; average cotton product per acre, 0.21 bale (sea island), 296 pounds seed-cotton, or 74 pounds cotton lint.

Clay county shows considerable variety in its topographical and agricultural features. The western part, being a portion of Trail ridge, has an elevation of 150 to 200 feet above sea-level. This elevation becomes less toward the east, being only a few feet above tide in the part of the county adjoining Saint John's river. Upon the elevated country west and southwest are found many beautiful lakes, some of which have open outlets, and are thus the partial sources of Black creek. Of these the most important are Kingsley's, Blue, Fish, and Sand Hill lakes. The first named is by some considered to be the highest above sea-level of any of the Florida lakes. Its elevation is given at 171 feet. In addition to these there are numerous lakes and ponds which have no apparent outlet, though they are probably drained by subterranean channels. In the eastern part of the county water from these channels breaks forth in a great number of springs. Green Cove springs, Montmorenci, and Blue springs are well-known sulphur springs.

Along Black creek, where much of the overlying sands has been removed by denudation, the country rock, which is usually a limestone, appears on the surface.

ABSTRACT OF REPORTS OF MESSRS. L. D. WALL, OF WILDERNESS, AND O. BUDINGTON, OF MIDDLEBURG.

The chief varieties of soil are pine lands with clay subsoil, pine lands with sandy subsoil, and black and sandy hummocks. Of these only the light sandy soils with substratum of clay are used to any considerable extent in cotton cultivation.

Upon the lowlands the growth of the cotton is quite dependent upon the seasons. In dry weather the soil cakes hard and cracks, and the cotton, not being able to penetrate it, often dwindles and dies. On the other hand, in very wet weather it is liable to scald and rust, sheds its bolls, and is frequently killed by too much water. On high lands (both pine and hummock) it does better, these having mulatto soils, which the tap-root can penetrate.

Light sandy soil with clay subsoil.—This comprises over half of the lands about Wilderness and Middleburg. The natural timber is long-leaf pine, with species of oak and some hickory. The soil is a light sandy loam of a whitish gray to brown color, with an average depth of perhaps 10 inches. The subsoil is heavier than the soil, being principally clay. On high lands, where farming has been carried on for many years, this subsoil becomes a hard-pan; but beneath the subsoil the clay is found sometimes to a depth of 20 feet, resting upon the lime rock of the country, which, however, is not always visible. The soil is easily tilled under most circumstances, and the usual southern crops are cultivated, sea-island cotton being planted on from one-eighth to one-third of the cleared land. The height of stalk varies from 2 to 8 feet, according to the quality of the land, being most productive at about 5 feet. On the richer land, especially on low land, and when planted too thickly, the cotton inclines to run to weed, and the same tendency is noticed when wet if it is cultivated with a turn-plow. To check this tendency shallow plowing and good hoeing are recommended, and also planting 4 or 5 feet apart and leaving only one or two stalks in the hill. The average seed-cotton product upon fresh land may be given at 400 pounds per acre, from 1,300 to 1,400 pounds of seed-cotton being required to make a 350-pound bale. The staple is classed as first rate. After ten years' cultivation without manure the yield falls two-thirds, with a slightly reduced proportion of lint and slightly deteriorated staple. The ordinary grasses, sand spur, crab-grass, and certain weeds, such as beggar-lice, sheep burrs, Spanish needle, etc., give most trouble.

A considerable proportion of this land, amounting in places to one-half, lies turned out, but it recovers its fertility rapidly, and when taken again into cultivation produces nearly as well as originally. This soil washes badly on slopes, and, while the uplands are injured, the valleys are usually improved by the washings. Horizontalizing is sometimes practiced with very good success.

The other varieties of soil mentioned above are seldom planted in cotton. A considerable proportion even of the first-class pine lands still remains uncleared and uncultivated.

Shipments are made by rail and steamer, principally in November, to Savannah and Charleston, the rates varying from $2 to $3 a bale.

PUTNAM.

Population: 6,261.—White, 3,845; colored, 2,416.

Area: 860 square miles.—Woodland, all. Pine lands, 600 square miles; swamp lands, 225 square miles; hummocks, 35 square miles.

Tilled lands: 11,788 acres.—Area planted in cotton, 1,356 acres; in corn, 2,675 acres; in oats, 566 acres; in rice, 12 acres; in sweet potatoes, 467 acres; in sugar-cane, 109 acres.

Cotton production: 347 bales; average cotton product per acre, 0.26 bale (sea island), 360 pounds seed-cotton, or 90 pounds cotton lint.

In Putnam county the following three natural agricultural divisions may be distinguished, viz: The western part, the river bottoms, and the peninsula east of the Saint John's river.

The western part is principally undulating pine lands of varying quality, with a substratum in many places of blue and red clay. The surface rises gradually toward the west, being near that border 150 feet or more above the sea. The soils west of the river vary in quality according to locality. Near the river the pine lands are low and flat, valuable chiefly for timber and as a range for cattle.

The river bottom-lands are mostly low, and were originally covered with a growth of cypress and oaks, and wherever these are 6 feet above the river-level they are in cultivation, principally in oranges and other fruit. The swamps are still generally covered with their original growth.

A part of the west bank of the Saint John's river in this county is formed of a strip of hummock land, presenting a bold front to the river; otherwise the river is bordered by swamp land.

On the so-called Fruit-land peninsula, which lies between the Saint John's river, on the west, and Crescent lake, Dunn's lake, and Deep creek, on the east, the cultivation of the orange forms the principal occupation. This peninsula is from 1 to 5 miles wide between Deep creek and Dunn's lake, and as far south as Rolleston consists of a narrow strip of hummock land, running back into flat pine land, which is under water during the rainy season. At San Mateo the hummock land bordering the river is of greater width, and rises into rolling pine land a hundred feet or more above the level of the river.

Between Dunn's lake and the Saint John's river that portion of the peninsula belonging to Putnam county is about 25 miles in length and some 8 miles in width, and for the most part is rolling pine land, with some hummock land skirting the lake and river (Hon. E. R. Chadwick).

Near the river are frequent beds of marl, which form productive lands. These marl-beds appear to belong to a comparatively recent geological formation, and the same may be said of the beds of fresh-water shells, which in places form low bluffs on the banks of the river. Similar varieties of soil are described under Clay county.

Cotton is shipped from various points along the Saint John's river to Charleston and Savannah. The rates are usually from $1 to $1 50 a bale.

ALACHUA.

Population: 16,462.—White, 6,446; colored, 10,016.

Area: 1,260 square miles.—Woodland, all, except a few acres of prairie. Pine lands, 1,000 square miles; hummocks, 200 square miles; swamp land, 60 square miles.

Tilled lands: 49,731 acres.—Area planted in cotton, 14,646 acres; in corn, 19,246 acres; in oats, 1,006 acres; in rice, 73 acres; in sweet potatoes, 845 acres; in sugar-cane, 361 acres.

Cotton production: 2,519 bales; average cotton product per acre, 0.17 bale (sea island), 240 pounds seed-cotton, or 60 pounds cotton lint.

Alachua county embraces the following principal varieties of land, viz: Oak and hickory pine lands (first class), level or rolling pine lands (second and third class), hummocks, and prairie land. Of these the level pine lands greatly predominate, making perhaps two-thirds of the county.

The eastern part of the county is elevated some 250 feet above the Atlantic, sinking toward the west to 70 eet. Near the line between this and Levy county is a range of sand-hills 120 feet above tide where crossed by the Transit railroad between Archer and Bronson stations.

In the vicinity of the Santa Fé and Suwannee rivers, which form the northern and western boundaries, the mean elevation is perhaps less than 70 feet, and in these localities the limestone often outcrops, giving rise to

hummock lands of excellent quality and considerable extent. The Suwannee river flows in a large part of its course between limestone banks. Through the crevices in this rock many large springs break forth; the waters of which are often impregnated with sulphureted hydrogen.

Extending from northwest to southeast through Alachua is a strip of varying width, where the limestone is near the surface and is very thinly covered with soil. Along this belt are many areas of fine hummock land, supporting a growth of oaks, hickory, black and sweet gum, bay, magnolia, beech, maple, and other hard woods. The substratum of all the hammock lands, so far as observations go, is an earthy variety, much disintegrated, of the limestone above alluded to.

The hummocks are very irregularly distributed along this belt, usually in small detached bodies of 100 to 500 acres. San Felasco hummock, north of Gainesville, however, embraces many square miles.

An analysis of a typical soil of this class, from Ocala, in Marion county, has been given in the general part of this report, and from it the average character of the soil may be seen.

ABSTRACT OF REPORTS OF P. B. TURPIN, OF WALDO, AND WILLIAM H. ROBERTSON, OF GAINESVILLE.

The varieties of soil are included in the several classes of pine lands, and the hummocks with smaller areas of swamp and prairie.

The hummocks make perhaps a sixth of the area of the county, and sustain a growth of oak, hickory, bay, and magnolia. Two kinds are recognized, viz., the black hummock and the gray hummock or "mixed land".

The soil of the black hummocks is a fine sandy loam of a brown to blackish color, 10 to 12 inches deep, with sandy subsoil usually, though sometimes the latter is a brownish-yellow clay. This contains in places fragments of a soft sand rock. It is underlaid with sand, clay, or hard-pan at 6 to 8 feet depth.

The soil of the gray hummocks differs from the above in being more sandy and of a lighter color. Its subsoil is usually a coarse yellow sand, sometimes almost white, and, beneath this, sand, sand rock, or hard-pan at 4 to 6 feet depth. The gray hummocks have usually some long-leaf pine, along with the other trees characteristic of such land.

These soils are easy of tillage in all seasons. About one-half is planted in cotton, though they are thought to be rather better adapted to sugar-cane and rice. The yield of seed-cotton (sea island) will average 600 to 700 pounds to the acre, one-fourth of the weight being lint. The usual height of the stalk is 5 or 6 feet, being most productive at 5. None of these lands are turned out of cultivation.

Outside of the hummocks and prairies, which together form perhaps a little less than one-sixth of the superficial area of the county, the prevailing growth is the long-leaf pine, with wire-grass. The soils of the pine lands vary considerably in productive qualities, and these variations are sufficiently well characterized by the natural growth associated with the pines. Upon the poorer areas, where the soil is most sandy, long-leaf pine, with some scrub oak, prevails, to the almost total exclusion of other trees. Where the soil becomes more loamy, red oak and hickory are associated with the pines.

The great proportion of the cotton of this county is produced upon the better class of pine lands. The soils rest upon a yellowish sandy subsoil, and this often upon a clayey foundation. From one-third to one-half of the cultivated lands of this sort are planted in cotton (sea island), which attains a height of 3 to 6 feet, being most productive at about 5 feet. The seed-cotton product on fresh land is about 500 pounds to the acre, 1,400 to 1,480 pounds of the seed-cotton yielding a 350-pound bale of No. 1 staple. Five or six years' cultivation without manures brings down the yield to 200 or 400 pounds per acre, the fiber becoming shorter and coarser, 1,225 to 1,445 pounds of seed-cotton, however, yielding a bale. Probably one-third of this land lies turned out; when again taken into cultivation it produces very well the second and third years.

From the level or slightly-rolling character of most of the land in the county there is little or no injury from washes or gullies.

The troublesome weeds everywhere are crab and crow-foot grass, sand spurs, Jerusalem oak, careless-weed, and "beggar-weed" The latter, however, is not an unmitigated evil, as it makes an excellent pasturage for stock, and is supposed to add to the fertility of the soil.

In wet weather, and when the rows are too close or the fruit sheds, the plant will tend to run to weed. Planting early, giving plenty of room and applying small quantities of potash or bone-dust for manure, will check this tendency.

The Atlantic and Gulf and West India Transit railroad crosses this county from northeast to southwest, and affords means of transportation for the products of Alachua. Cotton is shipped by this road to the coast, and thence by steamer or sail-boat to Charleston and Savannah. Most of the shipments are made during November, the usual rate being from $2 50 to $3 a bale.

LAFAYETTE.

Population: 2,441.—White, 2,268; colored, 173.

Area: 940 square miles.—Woodland, 830 square miles; coast marshes, 110 square miles; pine lands, 410 square miles, of which 200 or more are flatwoods; swamps, 280 square miles; hummocks, 140 square miles.

Tilled lands: 7,962 acres.—Area planted in cotton, 472 acres; in corn, 3,420 acres; in oats, 351 acres; in rice, none; in sweet potatoes, 103 acres; in sugar-cane, 56 acres.

Cotton production: 107 bales; average cotton product per acre, 0.23 bale (sea island), 316 pounds seed-cotton, or 79 pounds cotton lint.

Lafayette county lies between the Steinhatchee river, on the west, and the Suwannee, on the east, on the north reaching up nearly into the brown loam or red clay uplands, from which it slopes away southward to the Gulf. In consequence of this position, most of the varieties of soil occurring in Florida are met with in Lafayette. The greater proportion of the area is, however, pine land, with sandy soil, interspersed with large tracts of hummock land, among the most important of which may be mentioned Cooke's, Old Town, and Clay hummocks, and smaller bodies of similar land near the Steinhatchee; in addition, there are some areas of Gulf hummock A not inconsiderable area is also occupied by swamps, which are situated near the center of the county and toward its southern and southeastern borders.

Some of the pine lands have a subsoil of red clay or loam, and in this respect they resemble similar lands in Suwannee and Madison counties.

The limestone in Lafayette county not only extends down to the coast, but continues out to sea for several miles, a small depth only below the water-level. In this shallow water there is a heavy growth of aquatic grasses,

and near the shore is often a low, rocky ridge, formed of the flinty portions of the limestone. Rapids or cascades are produced in all the principal streams as they cross this flinty mass.

The abstract given under Taylor county, adjoining this on the west, describes the composition and agricultural capabilities of similar soils.

The Suwannee river is navigable to New Troy, the county-seat, and the products of Lafayette find their way to market by this channel, or they are hauled to the railroads and thence shipped.

LEVY.

Population: 5,767.—White, 3,732; colored, 2,035.

Area: 940 square miles.—Woodland, 890 square miles; coast marshes, 50 square miles; pine lands, mostly flatwoods, 620 square miles; hummocks, 160 square miles; swamps, 110 square miles.

Tilled lands: 15,645 acres.—Area planted in cotton, 3,665 acres; in corn, 7,250 acres; in oats, 2,096 acres; in rice, none; in sweet potatoes, 365 acres; in sugar-cane, 292 acres.

Cotton production: 1,251 bales; average cotton product per acre, 0.34 bale (sea island), 476 pounds seed-cotton, or 119 pounds cotton lint.

In the northwestern part of Levy county is a range of sand-hills, which, at the point where the Fernandina and Cedar Keys railroad crosses, between Bronson and Archer stations, is 120 feet above the Gulf level. From this ridge to the Gulf is a low, flat country, covered with sand, through which at intervals the underlying limestone makes its appearance, giving rise to hummock lands.

In the southwestern part of the county an extensive Gulf hummock, 100,000 acres in extent, is formed on both sides of the Wakasassa river down nearly to the Withlacoochee. Along the Wakasassa and its tributaries these hummocks reach up some distance into the interior.

Where the drainage of the Suwannee river has cut down to the limestone there are also occasional patches of rich hammocks, and similarly in the vicinity of the Withlacoochee.

The soils of Levy county are the varieties of sandy to loamy pine lands and hummocks.

The general descriptions of the pine-land soils of Columbia and Marion counties, of the hummock soils of Marion and Sumter, and of the marl which underlies and mingles with the sands of the Gulf hummocks of Wakulla county are applicable to this county.

In physical features, soils, etc., Levy is closely allied to Taylor county.

Shipments are by rail to the seaports, and thence by water to Savannah or Charleston.

MARION.

Population: 13,046.—White, 4,741; colored, 8,305.

Area: 1,680 square miles.—Woodland, all. Pine lands, 1,140 square miles; hummocks, 400 square miles; swamp lands, 140 square miles.

Tilled lands: 50,160 acres.—Area planted in cotton, 13,305 acres; in corn, 16,641 acres; in oats, 1,793 acres; in rice, 71 acres; in sweet potatoes, 1,803 acres; in sugar-cane, 274 acres.

Cotton production: 2,426 bales; average cotton product per acre, 0.18 bale (sea island), 256 pounds seed-cotton, or 64 pounds cotton lint.

In its physical features Marion has a close resemblance to Alachua county. Diagonally through this county from northwest to southeast runs an elevated belt of land, covered generally with sand, but diversified with extensive tracts of rich hummocks. The prevailing limestone of Florida makes its appearance at the surface at intervals throughout the county, and the earthy disintegrated portions of this rock, mingling with the sandy soil, constitute the high hummocks. A variety of the country limestone is highly siliceous, and may often be seen outcropping in large masses through the sandy soil without exerting any beneficial effect upon it. Between Silver Spring and Ocala limestone of this kind can be seen in several places, especially where exposed in the tramway cuts. The rock which underlies the high hummock land just south of Ocala is of a very different nature, especially as regards its influence upon the soil.

The Ocklawaha river traverses Marion county from south to north. This river is bordered by a swamp for most of its length, except where in a few localities the hummocks extend down to the river banks. Most of the drainage is received into underground passages or into lakes, and comes to light again in the big springs which are found near the Ocklawaha river and the lakes of the Saint John's, on the one side, and the Withlacoochee, on the other.

The most noted of these springs are Silver spring, near Ocala, the waters of which flow off in a navigable stream 9 miles long to the Ocklawaha, and Blue spring, which flows in a similar way into the Withlacoochee, in the southwestern part of the county. Orange spring, in the northeastern part of the county, strongly impregnated with sulphur, was once a place of resort for invalids.

While the soil throughout Marion county is sandy, yet the influence of the underlying limestone is almost everywhere felt, so that there is very little barren land within its limits. The sands are in places underlaid with small pebbles, and occasionally with a clayey sand, bringing about a variety of modifications.

The chief soil varieties are: 1st. Oak and hickory pine lands (first class), with associated high or gray hummocks; 2d. Light sandy pine-hills soils and sandy hummocks; and 3d. Swamp lands near water-courses and other low, wet places.

An analysis of oak and hickory pine-land soil from this county 9 miles north of Ocala, and of the gray hummock soil 1 mile south of Ocala, will be found in the general part of this report. Also an analysis of the light hummock soil from Leesburg, in Sumter county. It is believed that these analyses will show fairly the composition of the average soils which they represent throughout the middle portion, at least, of the peninsula. The largest and most important bodies of hummock land in Marion county are Tuscawilla (in part), Wetumpka, Moody's, Sugar, Long Swamp, and Ocala. These hummocks collectively make a large area of extremely valuable and productive land.

ABSTRACT OF REPORT OF J. L. BINNICKER, OF FLEMINGTON.

The soils described are:

1. *Oak and hickory pine lands and gray hummocks.*—This class of land forms perhaps one-half of the cultivated lands of the county. The timber upon the hummocks embraces live oak, white oak, water oak, magnolia, and bay, and upon the rolling pine lands red and black oaks, with hickory, are associated with the long-leaf pine. The soil is a dark-colored sandy loam, approaching black on the hummocks, and has a depth of 1 foot; the subsoil is sometimes small gravel, mixed often with clayey sand and fragments of the disintegrated limestone. This limestone has also its flinty portions, which mingle with the other materials of the subsoil. The soil is always well drained, being underlaid everywhere by the cavernous limestone. In very wet weather it is a little difficult of cultivation, and in dry weather is somewhat liable to suffer from drought. It is very well adapted to most of the southern crops, especially to corn, sugar-cane, and sweet potatoes. Sea-island cotton is cultivated on about one-third of the cleared land, growing to a height of 5 feet, but is most productive at about 4 feet. On fresh land a yield of from 400 to 700 pounds of seed-cotton (one-fourth weight being lint) may be expected, the staple being first class. After four or five years' cultivation without manure the yield on the hummocks is reduced to 400 pounds, and that on the pine lands to less, the staples from the old land rating quite as well as that from the fresh. In some localities nearly one-half of these lands originally under cultivation now lie turned out. After being taken again into cultivation the soil will for a few years produce as well as when fresh.

2. *Light pine land and sandy hummocks.*—Nearly one-third of the land about Flemington is of this nature. The timber is long-leaf pine, with shrubby oaks, live oak, and scrub and saw palmetto in hummocks. The soil, always sandy, is of a whitish to brown color, and is often 2 feet deep, down to a clayey, sandy subsoil, which contains in places fragments of the flinty parts of the limestone. About one-fifth part of these lands is devoted to cotton culture. The average height of the stalk is from 2 to 2½ feet, and it is most productive at this height. The fresh land will yield 300 pounds of seed-cotton to the acre, a bale of 350 pounds requiring about 1,500 pounds of the seed-cotton. The staple rates from fair to good. Three or four years' cultivation without manure will bring down the yield to 200 pounds or less, but the quality of the staple will not be changed. These uplands are soon exhausted without manure, and for that reason large plantations, once cultivated, now lie turned out. It is not generally considered profitable to reclaim such land, as it hardly pays for the fencing. On all these soils wet weather and too deep plowing sometimes cause the plant to run to weed. Thorough drainage and stopping the cultivation prevent this tendency. Jerusalem oak, cocklebur, and sand spurs are the worst weeds, the latter especially. From the level or gently-undulating character of most of these lands and the porous nature of the soils the injury from washes is comparatively trifling.

3. Occasionally in small bodies, near lakes or water-courses, are low, swampy spots, overgrown with ti-ti, palmetto, and short-leaf pine. The soil is a blackish muck, 1 or 2 feet thick, underlaid with white sand, something like quicksand, below which is often a clay. This soil is of easy tillage only in dry seasons, and is well suited to the orange tree. Such areas make also fine pastures. Only about one-tenth of this land is devoted to cotton culture, the plant often running up to a height of 10 feet, but with very little fruit. As the land, by reason of its low situation, cannot be drained, there seems to be no way of preventing this running to weed, which is caused by too much moisture. One hundred and fifty pounds of seed-cotton to the acre are yielded by fresh land, and this yield remains about the same after several years' cultivation, as the land is not easily exhausted. The staple rates fair to good. One-half of the originally cultivated land lies now turned out. It produces as well as ever after a few years' rest.

Cotton is hauled either to the Transit railroad or its branches, or to the Ocklawaha river, and is thence shipped by rail, steamer, or sail boat to Charleston or Savannah. Most of the shipping is done in November and December, and the rate is about $1 a bale by the water route; a little more when sent by rail.

VOLUSIA.

Population: 3,294.—White, 2,756; colored, 538.

Area: 1,340 square miles.—Woodland, 1,140 square miles; prairies and savannas, 200 square miles; pine lands, 740 square miles; swamp, 200 square miles; hummock, 200 square miles.

Tilled lands: 4,044 acres.—Area planted in cotton, 330 acres; in corn, 1,250 acres; in oats, 40 acres; in rice, 2 acres; in sweet potatoes, 508 acres; in sugar-cane, 57 acres.

Cotton production: 62 bales; average cotton product per acre, 0.19 bale (sea island), 264 pounds seed-cotton, or 66 pounds cotton lint.

A belt of tolerably high rolling pine lands, varying in width from 2 to 7 miles, extends centrally southward about 30 miles from the northern boundary of Volusia county. East of these pine lands is a belt of prairie extending the entire length of the county, affording fine pasturage for stock. East of the prairie belt, and occupying the lands on the west banks of the Halifax and Hillsborough lagoons, are rich hummocks.

Westward and southward from the pine belt follow rolling pine barrens, and then the lowlands, hummocks, and savannas of the Saint John's river. With this great variety in its physical features Volusia county shows a corresponding variety in its soils and productions. The hummocks have been cultivated chiefly in sugar-cane, as the high natural marling in these areas seems to cause the cotton to go too much to weed. The prairies and savannas are natural pastures, seldom cultivated. The pine lands are best suited to cotton. In these the soil is always sandy, in places somewhat loamy, and is occasionally mingled with calcareous matter. The face of the country is diversified with the usual abundance of lakes and ponds, and springs are numerous throughout the county.

ABSTRACT OF REPORT OF D. J. M'BRIDE, OF VOLUSIA.

The soil is sandy, and is of a whitish gray to brown color, according to locality, changing in color at perhaps 4 inches depth. The subsoil varies, being in some places heavier, and in others lighter, than the surface soil, and bringing about corresponding variations in the character of the land. It is always easily tilled, and produces good crops of corn, sugar-cane, cotton, sweet potatoes, etc. Only a small proportion of the land is planted in cotton, the sea-island variety being exclusively cultivated. The average height of the stalk when most productive is about 5 feet. The plant is inclined to run to weed when the soil is too rich or when forced too fast in spring. The remedy is to keep back the growth by "flat weeding".

The average seed-cotton product per acre of fresh land is about 500 pounds, and about 1,480 pounds are needed to make a 350-pound bale. This sells at from 30 to 35 cents per pound. After three years' cultivation without manure there seems to be no falling off in the yield, but after six or eight years it comes down to 300 or 400 pounds, of about the same proportion of lint and seed, but with slightly improved staple, as it sells better than that from fresh land by about 1 to 2 cents a pound. Crab-grass and sand spurs are the troublesome weeds on sandy land, while beggar-lice give most trouble on the hummocks. None of the originally-cultivated land is turned out, as it is all planted in orange groves. The country is so nearly level or so slightly undulating that no injury is sustained from washes.

Shipments of cotton are made in December and January, chiefly by the Saint John's river, etc., to Charleston and Savannah. The freight charge to these ports is $1 50 a bale.

ORANGE.

Population: 6,618.—White, 5,595; colored, 1,023.

Area: 2,250 square miles.—Woodland, 2,035 square miles; marsh, 75 square miles; prairie and savanna, 140 square miles; pine lands, 1,675 square miles; swamp, 220 square miles; hummock, 140 square miles.

Tilled lands: 11,762 acres.—Area planted in cotton, 818 acres; in corn, 2,763 acres; in oats, 140 acres; in rice, 8 acres; in sweet potatoes, 663 acres; in sugar-cane, 202 acres.

Cotton production: 143 bales; average cotton product per acre, 0.17 bale (sea island), 244 pounds seed-cotton, or 61 pounds cotton lint.

In the lake region, in the west of Orange county, the country is high and undulating, the hills on the borders of some of the lakes rising to a height of 70 feet above water-level. Eastward the land is more nearly level or gently undulating.

The soils are the usual varieties common in southern Florida, viz, rolling pine lands, better class, with sandy soil, underlaid by a loam which rests upon clay or marl. The prevailing timber upon such lands is long-leaf pine and red and black oaks, and occasionally hickory. The pines are large and of sturdy growth, and make the very best lumber. A second-class pine land has little else in the way of timber than pines, except in places a small growth of oaks. A third class of pine lands is seen in the fine pine barrens, with small pine, wire grass, and saw palmetto. Such lands, though occupying frequently high levels, are often half submerged during the rainy seasons. Hummock lands are found on the borders of the lakes and water-courses, as lake Apopka, Tohopekaliga, Jessup, and adjoining some of the swamps of the Saint John's in the northern part of the county. Around the swamps of the Wekiva and near the center of the county east and west are other bodies of hummock land of considerable extent.

The limestone underlying this county is not, as is the case in the middle and western counties, altogether of Vicksburg age, but in one place certainly, and probably along a belt of considerable width parallel with the Saint John's and 12 to 15 miles distant from it, the underlying limestone is of the Miocene or Middle Tertiary age.

Upon the high pine lands, where great thickness of sands overlie the country rock, lakes of all sizes and in great numbers are seen. In the lower levels, where the drainage has removed a part of the sands, the limestone sometimes outcrops in bold bluffs, as at Rock spring, Hoosier spring, and Clay spring, or it merely lies near the surface, influencing the surface soil and producing the hummocks.

Near the river at still lower levels occur in places swamps of considerable size, and along the river in the southeast a large area of prairie or savanna land, which supports always a luxuriant growth of grasses, forming the best natural pasture grounds.

The abstracts of the reports from Sumter and Marion counties will apply almost equally well here, and the analyses of the oak and hickory pine-land soil north of Ocala, of the dark-gray hummock land at Ocala, and of the light hummock land at Leesburg, will show fairly the composition of similar soils in Orange county. The low flat pine barrens soil here is in all respects similar to that of Columbia county north of Lake City, analysis of which is given in the general part of this report.

Railroads from lake Monroe and Astor, on the Saint John's river, to Orlando and fort Mason provide transportation from the interior of the county to that river.

Shipments are made from the above and other points on the Saint John's by boat to Savannah and Charleston at from $1 to $1 50 per bale.

SUMTER.

Population: 4,686.—White, 3,501; colored, 1,185.

Area: 1,380 square miles.—Woodland, all, except a few small areas of prairie. Pine lands, 1,000 square miles; hummocks, 130 square miles; swamps, 250 square miles.

Tilled lands: 14,550 acres.—Area planted in cotton, 2,527 acres; in corn, 6,909 acres; in oats, 627 acres; in sweet potatoes, 398 acres; in sugar-cane, 237 acres.

Cotton production: 419 bales; average cotton product per acre, 0.17 bale (sea island), 232 pounds seed-cotton, or 58 pounds cotton lint.

Sumter county, although resembling Marion in many particulars, differs from it in having a much larger proportion of lowlands and a greater number of lakes. In this respect it forms a transition to Orange county, south of it. From Dr. E. B. Miles, of Fort Mason, we get the following description of the "Florida mountains":

The highest land in the county lies west of lake Apopka. These highlands (called sand-hills by the natives) extend from the country lying between lakes Eustis and Apopka southward to the headwaters of Davenport creek, which empties into lake Tohopekalega, and thence through the Kissimee river into lake Okeechobee. These are, therefore, probably the highest lands in the lower part of the state, as the waters in the valleys flow southward, as above indicated, into lake Okeechobee, and through the Palatkaoaha creek and the great lakes Apopka, Harris, Dora, Eustis, and Griffin northward through the Ocklawaha river. In going southward, the first and most notable of these peaks is Table mountain (so called from its flat top). A mile or two further south are two more elevations still greater—Mount Sumter and Prospect mountain; and beyond these, Mount Hudson, with the most abrupt ascent of all. Its eastern side is so steep that it cannot be climbed directly. With this exception, these mountains have gentle ascents, and their broad summits and sloping sides are covered with a growth of pines and wire-grass.

In the northern and western parts of the county there are large bodies of fine hummocks similar to those of Marion, and in the southern part there is much low and often swampy land, alternating with prairies or savannas, dotted with numerous lakes. The cultivation of cotton (sea island) in Sumter county has not yet reached large proportions, though much of the land is well suited to this crop. Fruit culture has heretofore been one of the chief pursuits of the inhabitants.

The usual varieties of soil described under Marion and Alachua counties are also represented in this county. These are: First, oak and hickory pine lands (first class), with soil of a dark-brown color and somewhat loamy; second, high rolling pine lands (second class), with sandy soil; and third, light-gray or sandy hummock soil, the latter being usually associated with sandy pine lands. The dark-gray hummocks occur in the western and northwestern

parts of the county, and are in all respects similar to those of Marion, of which they are the continuation. The analysis of a soil of this character from Marion county is given in the general part, where the dark gray hummock south of Ocala has been described. The dark-brown loamy soils are similar to that described and analyzed from the uplands north of Ocala.

The subsoil of the light gray hummock near Leesburg below the depth of 1 or 1½ feet is a light yellow, nearly white sand, and below this a yellowish clayey sand, which is used sometimes in brick-making. The bricks are quite friable, however, and are useful only for light work, such as furnaces for sugar-boiling.

The clay or loam which underlies the stiff, heavy hummocks, such as have been described under Marion county, is of a darker color, and less sandy than is the case with the under-clay of the light hummocks.

ABSTRACT OF REPORT OF GEORGE M. LEE, OF LEESBURG.

In the neighborhood of Leesburg two-thirds of the land is pine land, with sandy soil, mostly of a light or grayish color, the associated hummocks having darker-colored soil, still quite sandy. This hummock soil is usually said to have a clayey subsoil, but the proportion of clayey matter is quite small. Upon the highlands the timber is mostly long-leaf pine, with an undergrowth of oak bushes and wire-grass. In the hummocks are live oak, water oak, hickory, red bay, and evergreen, with saw palmetto as an undergrowth. The soils of the pine lands and of the light hummocks are always of easy tillage, and are usually well drained. The ordinary southern crops all do well; about one-fourth the land cultivated is now planted in cotton (sea island). In wet seasons the plant shows a tendency to run to weed. On fresh pine land the yield of seed-cotton per acre is 300 to 400 pounds; on the hummocks, 400 to 800 pounds, according to quality. For a 350-pound bale 1,400 pounds of seed-cotton are usually required. With cultivation for several years without manures the yield is diminished one-third or more, and the staple is not considered so good. Sand spurs and careless-weed are considered most troublesome to the farmer. A small proportion only of this land originally cultivated is now turned out; but this, upon being reclaimed, produces nearly as well as fresh land for a few years, gradually falling off after that time. No injury is caused by washes, as the land lies comparatively well, and the sands absorb quickly the rains which fall upon them. The swamp lands of Sumter are, as a general thing, unreclaimed. The third-class pine lands, of which there is a considerable proportion, are not planted in cotton. Shipments are made by boat on the lakes and the Ocklawaha river to the seaports, and thence by steamer and sail-boat to Charleston and Savannah. The rates vary from $1 to $2 a bale.

HERNANDO.

Population: 4,248.—White, 3,319; colored, 929.

Area: 1,700 square miles.—Woodland, 1,540 square miles; pine land, 1,340 square miles; hummocks, 100 square miles; swamps, 100 square miles; prairie, 80 square miles; sea marsh, 80 square miles.

Tilled lands: 14,691 acres.—Area planted in cotton, 1,558 acres; in corn, 10,883 acres; in oats, 1,371 acres; in rice, 88 acres; in sweet potatoes, 619 acres; in sugar-cane, 383 acres.

Cotton production: 468 bales; average cotton product per acre, 0.30 bale (sea island), 420 pounds seed-cotton, or 105 pounds cotton lint.

Hernando in its topography and soils shows a greater variety, perhaps, than any other county on the peninsula.

From the Withlacoochee, on the north, to Brooksville there is a high, hilly country, with a subsoil of yellowish sandy clay or loam, possessing in general excellent soil, interspersed, however, with spots of poor pine land.

Near Brooksville are two of the largest bodies of hummock land in the state, known as the Annuttelaga and Choccochattie hummocks. In each of these are found high hills and a variety of soils, all, however, highly productive and well suited to most crops.

In the eastern part of the county and along the Withlacoochee river are other excellent hummocks, with some prairie and savanna land. Westward toward the Gulf the lands as a class are level flatwoods, interspersed with Gulf hummocks near the coast. In this region Mount Lee, near the head of Homosassa river, rises to a height of 214 feet, according to the statement of Captain Reynolds; and according to the same authority other hills in the county have an elevation of 170 feet.

South of the Withlacoochee, near the coast, is a large tract of swamp land eight or ten miles in length and three or four in width. The growth upon the high hummocks above mentioned consists of white, water, and live oaks, hickory, red bay, magnolia, ash, sweet and black gum, elm, dogwood, and ironwood, and on some of the hummocks red cedar.

Southward from Brooksville the prevailing flat pine woods are diversified with lakes and bodies of hummock land. The flatwoods afford excellent pasturage, and stock-raising gives occupation to many. On the headwaters of the Hillsborough river are numerous rich hummocks.

In the vicinity of the coast, from the mouth of the Withlacoochee to that of the Wekawatchee river, the sand and soil have, to a large extent, been washed away, laying bare the underlying limestone, giving rise to rocky hummocks and Gulf hummocks; and in this region limesinks and large springs are characteristic features.

Crystal and Homosassa rivers are both short "runs" from limestone springs. The scenery along the coast is also diversified by many lakes of clear water.

It will thus be seen that Hernando presents the characters rather of one of the counties of the Brown Loam upland region of middle Florida than of the peninsula.

The extension of the limestone down to the sea-level seems to be characteristic of the coast from the Apalachee bay southward nearly to Tampa bay, a circumstance already noticed by Williams, who says the navigation of all the streams from the Saint Marks to the Suwannee is impeded by a stratum of this rock, which has a kind of flint imbedded in it, and when the waves have washed the calcareous matters away these flinty nuclei form extensive and rugged reefs.

Lack of transportation is a serious drawback in this county. Cotton is hauled to the various ports on the Gulf, and is thence shipped by steamer or sail-boat to Charleston and Savannah at an average rate of 75 cents per hundred pounds.

HILLSBOROUGH.

Population: 5,814.—White, 4,899; colored, 915.

Area: 1,300 square miles.—Woodland, all; pine lands, 1,185 square miles; swamps, 75 square miles; hummocks, 40 square miles.

Tilled lands: 11,261 acres.—Area planted in cotton, 556 acres; in corn, 4,968 acres; in oats, 98 acres; in rice, 23 acres; in sweet potatoes, 583 acres; in sugar-cane, 238 acres.

Cotton production: 150 bales; average cotton product per acre, 0.27 bale (sea island), 376 pounds seed-cotton, or 94 pounds cotton lint. Five per cent. of the tilled lands are devoted to cotton culture.

Hillsborough county is undulating, even somewhat hilly, the prevailing soil being sandy, but becoming more loamy toward the east, where much of the high land, especially in the northeastern part of the county, has a substratum of red or yellow loam, similar to that so common in the counties of middle Florida. Westward the subsoil is sandier, and the natural growth more predominantly the long-leaf pine, except where the country rock (the usual limestone) is brought by the removal of the overlying sands by denudation near enough the surface to influence the soil, when the high hummocks, with their varied growth of live oak, white oak, red bay, and magnolia, are produced. The high lands with loam subsoil support a growth consisting of long-leaf pine, mingled with red and black oak and hickory. East of Tampa bay the land is generally timbered with pine, though some of it with clay subsoil is tolerably fertile; southeastward most of the land is rather flat.

The cultivated soils may be included under three heads: 1. *Pine lands of various qualities;* 2. *High hummocks;* 3. *Low hummocks.*

ABSTRACT OF REPORT OF W. F. WHITE, OF DUNEDIN.

1. *Pine lands.*—These lands are high and generally quite level, but more broken in the northeast. The usual growth, according to the quality of soil, is long-leaf pine and scrub oak, with which black-jack, turkey, and water oaks are associated as the soil improves in fertility. About three-fourths of the county is pine lands. The soil is in the west a fine, sandy, gray loam; in the eastern part of the county heavier, becoming in places a yellowish clay loam. The thickness of soil is variable, being sometimes of uniform quality for 2 feet. The subsoil is usually of a heavier nature, being in part a white sand and in places sandy loam of yellowish and mahogany colors. In the latter cases the subsoil may be mixed to advantage with the surface soil. In the low pine flats subject to overflow the subsoil is mixed with a great quantity of sea-shell fragments. The whole county has a substratum of limestone—often earthy, sometimes flinty—at varying depths from the surface. These pine-land soils are usually easy to cultivate, being a little more difficult in wet seasons, and they are all naturally well drained. The chief crops are sea-island cotton, sweet potatoes, sugar-cane, and corn, and the soil is apparently, next after tropical fruits, best adapted to the cultivation of cotton, which makes about three-fourths of the cultivated crop. The average height of stalk is about 5 feet, and it is most productive between 3 and 5 feet.

On fresh land the average seed-cotton product per acre is given at 300 pounds, 1,600 pounds being needed to make a 400-pound bale; the staple is of first quality. Three years' cultivation without manure will reduce the yield to 150 pounds, without making, however, any material change in the quality of the staple or in the proportion of lint to seed-cotton. Very little of the land originally cultivated lies turned out, but rotation of crops is commonly practiced, with good results; for after two or three years' rest, or a change of crops, the soil produces about as well as it did originally.

2. *High hummocks.*—These constitute not more perhaps than one one-hundredth part of the cultivated lands, and they occur rather more abundantly in the eastern than in the western part of the county. The timber is the usual hummock growth of oaks and other hard woods. The soil exhibits many varieties, being sometimes a light sandy loam, sometimes a heavier clay loam. Colors vary also from buff to yellow, mahogany, and brown. The subsoil in places is a clay, sometimes a cold, hard sand apparently. These hummock soils are always well drained, generally early and warm, and are well adapted to any of the southern crops. Cotton is, however, planted upon about one-half the area. It attains the usual height of 4 to 6 feet. The fresh land will yield from 400 to 800 pounds of seed-cotton to the acre, and about one-fourth its weight of lint-cotton, which rates as first quality. With proper cultivation, the soil will hold its own for years; it is not known how long. All hummock lands originally cleared are in cultivation.

3. *Low hummocks, with saw-grass, including marshes.*—About the same proportion, one in one hundred, of the county area is of this character, as of high hummock land. Low hummocks and marshes, etc., are found scattered all over the county. Cypress, bay, and maple form the chief growth, and where there is no cypress then there is usually an undergrowth of mere brush.

The soil is a black or brownish-black vegetable mold of varying thickness, resting usually upon a heavy cold sand, which seems to be impervious. This subsoil is underlaid sometimes by sand and sometimes by rock at 1 to 10 feet depth.

The soil is difficult to cultivate, being too wet or too dry, according to the season, and is very little adapted to cotton, of which only a small proportion is planted. Thorough drainage would probably render these spots as good as any in the county.

The plant tends to run to weed occasionally from causes not understood, sometimes because of wet weather. In the first case thorough cultivation and the importation of new seed, in the second the stopping of cultivation for the time, have been found effective remedies. Sand spurs and crab-grass are the most troublesome weeds. These lands usually lie so favorably that there is little if any injury from washes. The valleys are sometimes slightly injured, sometimes benefited, by the washings from the higher levels; but no general rule holds good. Stock-raising is still one of the most important lines of business here, as in Manatee county adjoining.

Cotton is usually shipped, as fast as baled, from the ports of Tampa, Clear Water, Dunedin, etc., by steamer or sail-boat, to Charleston and Savannah. The usual rate is 75 cents a hundred.

POLK.

Population: 3,181.—White, 3,033; colored, 148.

Area: 2,060 square miles.—Woodland, 1,960 square miles; pine lands, 1,760 square miles, one-half flatwoods; swamp lands, 160 square miles; hummocks, 40 square miles; prairie, 100 square miles.

Tilled lands: 8,688 acres.—Area planted in cotton, 481 acres; in corn, 5,593 acres; in oats, 269 acres; in rice, 20 acres; in sweet potatoes, 484 acres; in sugar-cane, 154 acres.

Cotton production: 95 bales; average cotton product per acre, 0.20 bale (sea island), 276 pounds seed-cotton, or 69 pounds cotton lint.

The surface of Polk county is generally level or slightly undulating, and with apparently no great elevations. Lakes of all sizes from 10 acres area to 5 miles across are numerous throughout the county, especially west of Peace creek. The lands between the lakes are somewhat elevated and rolling.

The underlying limestone is, as a general thing, well hidden by the sands, and makes its appearance at the surface in very few places. Near Peace creek there are some limestone and sulphur springs, which flow off into that stream.

On the east a chain of large lakes, connected by the Kissimee river, forms the boundary between this and Brevard county. The principal soil is the gray, sandy soil of the pine lands, which covers perhaps three-fourths of the county. Subordinated to this are the hummocks and prairies, and occasionally a small area of what is termed red hummock land, so called from its red subsoil. The pine lands show the usual varying degrees of fertility.

ABSTRACT OF REPORT OF MR. S. B. BONHAM, OF BARTOW.

The most important soil varieties are:

1. *Gray pine-lands soil.*—This covers about three-fourths of the county, and while inferior in fertility to the others is yet more important on account of its wider distribution. The prevailing growth is the long-leaf pine; in low places, gallberry bushes. The soil is fine, sandy, of whitish-gray to buff colors, of uniform substance for 1 or 2 feet, below which depth it passes into a somewhat heavier subsoil, containing hard "black gravel", the whole underlaid by sand and sometimes by lime rock at 5 or 6 feet depth. Tilling qualities of the land easy in all seasons. About one-fourth of the cultivated soil is in cotton, which attains a height when most productive of 3 feet. A yield of 150 pounds of seed-cotton to the acre (averaging one-third its weight of lint) may be realized upon fresh land. The cotton (sea island) is worth in the market from 35 to 40 cents a pound. On some of these lands the yield of cotton is by a few years' cultivation, even without manure, increased to 200 pounds of seed-cotton per acre.

2. *Hummock land.*—In the vicinity of Bartow only a small proportion of the land is of this character, one one-hundredth. The hummocks bear the usual variety of timber, pine, oaks, hickory, ash, elm, and palmetto, with and without saws. The soil exhibits a great variety of colors, varying from gray to nearly black. It is supported by sand, or occasionally lime rock, at 3 to 4 feet depth.

The principal crops are corn, sugar-cane, potatoes, rice, oats, and cotton; of these, cotton is cultivated on about one-twentieth of the tilled area. The stalk often attains a height of 6 feet or more, but is most productive at 3 or 4. The seed-cotton product of fresh land is 250 to 300 pounds, yielding one-third its weight of lint, selling at 30 cents a pound. Two years' cultivation without manure will bring down the yield to 200 pounds. One-tenth of the originally cultivated hummock lands lies now turned out, but on reclamation it produces about as well as when fresh.

3. *Red hummock.*—The area formed by this class of soil is very small, and cannot well be estimated. The usual growth is hickory, live oak, ash, and grape-vines. The soil is a mahogany-colored clay loam 1 or 2 feet thick, with a reddish loamy subsoil, containing flinty pebbles, and underlaid at 4 or 5 feet depth by lime rock. It is an extremely fertile soil adapted to all the southern crops. About one-tenth of it is usually in cotton, which grows to a very great height, being mostly weed, and producing badly—only 50 pounds of seed-cotton to the acre. Though not well suited to cotton, all land of this kind is in cultivation, as it will bring 50 bushels of corn to the acre.

Upon all the soils described the cotton-plant is inclined to run to weed by too wet weather, and topping is the usual remedy. Sand spurs and cockleburs are troublesome upon all the soils, and, in addition to these, Spanish needles, careless weed, and beggar lice become troublesome upon the rich red hummock land. The generally level surface of the county prevents any serious injury from washes.

Most of the shipments of cotton are made during October by steamer to Savannah and Charleston, and the rate is about $1 per bale.

BREVARD.

(See under "Pitch Pine, Treeless, and Alluvial Region".)

III.—PITCH PINE, TREELESS, AND ALLUVIAL REGION.

Comprising in western Florida parts of Escambia,* Santa Rosa,* Walton,* Washington,* Calhoun,* and all of Franklin; in middle Florida parts of Liberty,* Wakulla,* Jefferson,* and Taylor;* in eastern Florida parts of Nassau,* Duval,* and Saint John;* on the peninsula parts of Lafayette,* Levy,* Hernando,* Hillsborough,* Manatee, and Polk,* all of Monroe, Dade, and parts of Brevard, Orange,* and Volusia.*

ESCAMBIA.

(See "Long-leaf pine region".)

SANTA ROSA.

(See "Long-leaf pine region".)

WALTON.

(See "Long-leaf pine region".)

WASHINGTON.

(See "Long-leaf pine region".)

CALHOUN.

(See "Long-leaf pine region".)

FRANKLIN.

Population: 1,791.—White, 1,199; colored, 592.

Area: 690 square miles.—Woodland, 490 square miles; marshes, 200 square miles; pine lands, 390 square miles, mostly flatwoods; swamps and hummocks, 100 square miles.

Tilled lands: 521 acres.—Area planted in cotton, none; in corn, 145 acres; in oats, none; in rice, none; in sweet potatoes, 197 acres; in sugar-cane, 81 acres.

Cotton production: None.

In a general way Franklin county may be described as a sandy level, a few feet above tide-water, except along the river and between its five mouths, where the country is marshy and covered with rank aquatic grasses.

The limestone is seldom seen, especially west of the river in Franklin; but shallow ponds abound everywhere, and lake Winico is a large body of water in the western part of the county, 6 to 8 miles long, with an outlet into the Apalachicola river. A few gardens are the only attempts at cultivation of the soil. Apalachicola, the county site, was formerly an important port, but its prosperity has, in great measure, passed away. To this port most of the products of the county are sent for shipment.

LIBERTY.

(See "Long-leaf pine region".)

WAKULLA.

(See "Long-leaf pine region".)

JEFFERSON.

(See "Oak, hickory, and pine upland region".)

TAYLOR.

(See "Long-leaf pine region".)

NASSAU.

(See "Long-leaf pine region".)

DUVAL.

(See "Long-leaf pine region".)

SAINT JOHN'S.

(See "Long-leaf pine region".)

LAFAYETTE.

(See "Long-leaf pine region".)

LEVY.

(See "Long-leaf pine region".)

HERNANDO.

(See "Long-leaf pine region".)

HILLSBOROUGH.

(See "Long-leaf pine region".)

MANATEE.

Population: 3,544.—White, 3,378; colored, 166.

Area: 4,680 square miles.—Woodland, 3,350 square miles; prairie, 1,100 square miles; marsh, 230 square miles; pine lands, 3,030 square miles; swamps, 200 square miles; hummocks, 120 square miles.

Tilled lands: 5,257 acres.—Area planted in cotton, none; in corn, 2,668 acres; in oats, none; in rice, 22 acres; in sweet potatoes, 436 acres; in sugar-cane, 124 acres. 241

Cotton production: None.

Manatee county, like Polk, has a generally level surface, diversified with ponds and lakes, with gently rolling pine lands (mostly Cuban or pitch pine) between. Peace creek, with its chief tributary, the Charles Apopka, flows nearly through the center of the county. Near these water-courses the underlying limestone appears sometimes at the surface, though its presence is oftener indicated by the fertile hummocks and by limestone springs, which flow off into the creeks. A subsoil of clayey loam underlies some of the best pine lands of Manatee, and part of the prairies also appear to have a clay subsoil.

A large part of the county is prairie land covered with rank grasses, which afford excellent pasturage for cattle, and stock-raising is a most important occupation.

The Manatee river on the west is one of the largest streams after Peace creek. Myakka river flows into Charlotte harbor near its upper end. Near the headwaters of this river are some large lakes and a great tract of prairie land.

As yet little or no cotton is produced in Manatee county.

Peace creek, which has been made navigable as far as Fort Meade, in Polk county, is the chief outlet for the productions of this county to Charlotte harbor.

POLK.

(See "Long-leaf pine region".)

MONROE.

Population: 10,940.—White, 7,659; colored, 3,281.

Area: 2,600 square miles.—Woodland, a small proportion of everglades, marshes, prairies, and savannas make up the greater part of the county, and it is impossible to give estimates of the proportion of each.

Tilled lands: 1,705 acres.—Area planted in cotton, none; in corn, 64 acres; in rice, 3 acres; in sweet potatoes, 48 acres; in sugar-cane, 26 acres.

Cotton production: None.

Monroe county includes a comparatively small proportion of cultivated lands, a large part of its area being covered by cypress swamps and everglades, and it is only in the northern part of the county that the land is much under cultivation.

A number of islands and keys, the most important of which is Key West, the county seat, belong to Monroe county. Upon these the cultivation of tropical fruits is an important industry.

Adjacent to the Caloosahatchee river and Charlotte harbor are pine lands (pitch pine), which pass gradually into a savanna or prairie, with groves or clumps of hummock land heavily timbered, interspersed with ponds and lakes of clear water.

With the draining of the everglades a vast amount of savanna and prairie land will be made available for agricultural purposes.

DADE.

Population: 257.—White, 190; colored, 67.

Area: 7,200 square miles.—Woodland, a strip along the coast and in the northern part of the county, about 500 square miles; of the rest, everglades, marsh, prairie, savanna, and swamp, it is impossible to give a trustworthy estimate of the proportions.

Tilled lands: None.

The greater part of the area of Dade county is occupied by the everglades, by the prairies and savannas which skirt it, and by lake Okeechobee, in the northwestern corner, which covers an area of over 500 square miles.

The following descriptions have been compiled from various sources, chiefly from the publications of the bureau of immigration:

Along the Atlantic coast there is a strip of rocky pine lands from 3 to 15 miles wide, and having a considerable elevation above the sea. The rock here is apparently the same which forms the substratum of the entire county, and it is described as an oolitic and crystalline limestone, which is sometimes quite soft and easily cut and hardens on exposure to the atmosphere, being thus suitable for building purposes.

The pine lands are skirted with a strip of prairie or savanna land from half a mile to a mile in width, reaching to the everglades. It is thought by some that this prairie strip has been formed by the recession of the water, by evaporation, or by upheaval. This prairie comprises some of the richest land in the state.

The everglades, which form so singular and unique a feature of Florida, may be described as a shallow lake of vast extent occupying a basin or depression in the limestone of the country.

From surveys recently made it is known that the whole bed of the everglades has considerable elevation above the sea, so that the draining of this area is merely a question of time and expense.

All the streams which flow from the everglades are interrupted by falls or rapids. The Caloosahatchee is navigable by steamers to within 10 miles of lake Okeechobee, where the rapids begin.

The water through the everglades varies in depth from 6 inches to as many feet, and is filled with aquatic and semi-aquatic grasses and other plants. From this maze of water and vegetation rise innumerable islands, containing from 1 acre to 100 acres of land. These islands are covered with a growth of cypress, sweet bay, crab-wood, mastic, cocoa palms, cabbage palmetto, and live and water oaks, beneath which bloom flowers in almost endless variety.

Notwithstanding the shallowness of the water in the everglades and the profuseness of the vegetation growing in it, it is comparatively pure and clear, and abounds in fish, turtles, and alligators. Bears, panthers, wild-cats, and deer inhabit the islands.

Lake Okeechobee is about 50 miles long from northwest to southeast and about 20 miles broad, and is from 8 to 20 feet deep. Its northeastern and eastern shore is skirted with a low hummock of red bay, live oak, water oak, and other timber; its western and southwestern shore with a dense growth of saw-grass.

The lake has no visible outlet except as its waters soak through the everglades, and the lands around the lake can never be made available till the waters are lowered by artificial canals.

The soil of Dade county is generally sandy, but mingled in places with lime. The sea-island variety of cotton grows well on this soil, and is perennial here, and can be picked at almost all seasons of the year.

The soil of the prairies and savannas, on account of the vegetable matter and the influence of lime, is exceedingly rich, and the draining of the everglades will make available many square miles of soil of similar character.

Between Fresh Water creek and Cape Sable the prairie approaches near the coast, extending into the country about 15 miles, and is interspersed with hummocks of good land. This prairie usually terminates in cypress swamps, and these in the interminable glades (Williams).

BREVARD.

Population: 1,478.—White, 1,379; colored, 99.

Area: 4,390 square miles.—Woodland, 1,840 square miles; prairie and savanna, 1,750 square miles; marsh lands, 800 square miles; pine lands, 1,340 square miles; swamp and hummock, 500 square miles.

Tilled lands: 1,952 acres.—Area planted in cotton, 6 acres; in corn, 555 acres; in oats, 5 acres; in rice, 13 acres; in sweet potatoes, 160 acres; in sugar-cane, 152 acres.

Cotton production: 2 bales; average cotton product per acre, 0.33 bale (sea island), 464 pounds seed-cotton, or 116 pounds cotton lint.

Brevard county is best known from the oranges, pineapples, and other tropical fruits which are produced, chiefly along Indian river. The culture of cotton is of minor importance. It presents a considerable variety in its soils and surface configuration. The western shore of Indian river is skirted with cabbage hummocks on a rich but rocky surface (Williams). The coquina rock makes the river banks in many places; beyond this hummock land often follows pine lands of varying quality, and then grassy savannas and swamps. A very considerable proportion of the county is prairie or savanna land, and on this account stock-raising is an important industry.

In many respects Brevard resembles Manatee county, much of whose description will apply equally well here.

The products of this county find their way to market by the Indian river.

ORANGE.

(See "Long-leaf pine region".)

VOLUSIA.

(See "Long-leaf pine region".)

PART III.

CULTURAL AND ECONOMIC DETAILS OF COTTON PRODUCTION.

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REFERENCE TABLE

OF

REPORTS RECEIVED FROM FLORIDA COUNTIES.

OAK, HICKORY, AND PINE UPLAND REGION.

Jackson.—JAS. V. BURKE. Marianna, March 30, 1880. Refers to township 5 north, ranges 11 and 12 west. Describes the red lime-lands, loam uplands, and long-leaf pine uplands.

Gadsden.—JESSE WOOD. Mount Pleasant, October 1, 1880. Refers to township 3 north, range 5 west. Describes the loam uplands and long-leaf pine table-lands.

Leon.—JOHN BRADFORD. Tallahassee, March 5, 1880. Refers to townships 1 and 2 north, ranges 1 and 2 east, and describes the oak uplands, with associated long-leaf pine uplands.

1. *Jefferson.*—J. P. GRANTHAM. Waukeenah, September 1, 1880. Refers to township 1 south, range 4 east. Describes loam and pine uplands, light hummocks, and flatwoods.
2. *Jefferson.*—JAMES F. TUCKER. Monticello, March 16, 1880. Refers to townships 2 and 3 north, ranges 6 and 7 east. Describes high hummocks, first and second class pine lands, and flatwoods.

LONG-LEAF PINE REGION.

Santa Rosa.—DR. JOHN M. MCGEHEE. Milton, December 18, 1880. Refers to entire county, and describes second and third class pine lands.

1. *Hamilton.*—THOMAS N. BELL. Jasper, July 1, 1880. Refers to township 1 north and range 14 east. Describes flatwoods and pine uplands.
2. *Hamilton.*—HENRY J. STEWART. Jasper, February, 1880. Refers to the uplands and lowlands contiguous to Tiger creek, and describes sandy upland soil.

1. *Suwannee.*—L. A. JENNINGS. Live Oak, January 4, 1880. Refers to the entire county. Describes first, second, and third class pine lands.
2. *Suwannee.*—GEORGE E. DEXTER. Houston. Refers to township 2 south, range 14 east. Describes first-class pine lands, gray or gravelly lands, and black hummocks.

1. *Columbia.*—G. B. SMITHSON. Lake City, February 20, 1880. Refers to township 3 south, range 16 east. Describes the three classes of pine lands.
2. *Columbia.*—T. R. COLLINS. Mikesville, February 27, 1880. Refers to township 6 south, range 17 east, and describes the pine lands and hummocks.

Saint John's.—COL. N. R. FITZ HUGH. Picolata. Describes the pine lands.

1. *Clay.*—O. BUDINGTON. Middleburg, January 7, 1880. Refers to township 5 south, range 24 east. Describes the better class of pine lands.
2. *Clay.*—LAWRENCE D. WALL. Wilderness, March 10, 1880. Refers to the entire county. Describes the same class of lands as the preceding.

Hillsborough.—W. F. WHITE. Dunedin, January 30, 1880. Refers to township 28 south, range 15 east. Describes pine lands and high and low hummocks.

1. *Alachua.*—P. B. TURPIN. Waldo. No date. Refers to the entire county, and describes pine lands and hummocks.
2. *Alachua.*—WILLIAM H. ROBERTSON. Gainesville, October 19, 1881. Refers to Payne's prairie and lowlands of Pithlachocco, or Newnan's lake, and the level pine lands and hummocks near Gainesville. Describes black and gray hummocks and pine land.

Marion.—J. L. BINNICKER. Flemington, February 16, 1880. Refers to townships 12 and 13 south, ranges 20 and 21 east. Describes the pine and associated hummock lands.

Sumter.—GEORGE M. LEE. Leesburg, September 23, 1880. Refers to township 19 south, range 24 east, and describes second-class pine lands and low sandy hummocks.

Polk.—SCOTT B. BONHAM. Bartow, January 10, 1880. Refers to the country about Bartow. Describes hummocks and gray pine lands.

Taylor.—JOHN B. CARRIN. Stephensville, January 22, 1880. Refers to townships 8 and 9 south, ranges 9 and 10 east. Describes two varieties of pine lands and high hummocks.

Volusia.—D. J. MCBRIDE. Volusia, March 18, 1880. Refers to township 15 south, range 29 east, and describes the better class of pine lands.

ABSTRACTS OF THE ANSWERS TO SCHEDULE QUESTIONS.

TILLAGE, IMPROVEMENTS, ETC.

1. Usual depth of tillage (measured on land side of furrow), and draft employed in breaking up.

Four to six inches is the usual depth of tillage in preparing the land; 2 inches in cultivation. The draft employed is mostly one horse or mule, occasionally two horses or a yoke of oxen.

2. Is subsoiling practiced? If so, with what implements, and with what results?

In most counties subsoiling seems to be practiced not at all; in a few cases, Jackson, Gadsden, Columbia, with Watts' subsoil plow, with bull-tongue plow, etc. As to results, opinions are about equally divided, some holding that the soils are improved, others that they are injured by subsoiling.

3. Is fall plowing practiced? With what results?

In some counties fall plowing is not practiced; in others, very little, except in sowing oats. In every case where practiced the results are good; "the green vegetation turned under equals a coat of manure."

4. Is fallowing practiced? Is the land tilled while lying fallow, or only "turned out"? With what results in either case?

Hamilton, Columbia, and Hillsborough report no fallowing practiced. In the other counties the practice is followed to some extent. Results always good, except where cattle are allowed to graze upon the land when "turned out". In Leon county, where land is "turned out", it is apt to grow up in broom-sedge, which does not seem to improve it. In Alachua and Polk fallow land is sometimes sown in cow-peas; in the others it is simply "turned out". "When land is turned out a year or two it yields nearly as well as fresh land, and is easier to cultivate."

5. Is rotation of crops practiced? If so, of how many years' course, in what order of crops, and with what results?

In Santa Rosa, Hillsborough, Marion, and Saint John's systematic rotation of crops is not generally practiced; in the other counties the order of crops is: corn, cotton, oats, and pease, or sweet potatoes, or fallow; in Jackson and Taylor, a rest every third year is reported. In Gadsden, a good sweet potato crop can be made by planting the vines after oats are cut. Wherever systematic rotation of crops is practiced the results are reported good; "the lands are kept at a uniform degree of fertility."

6. What fertilizers or other direct means of improving the soil are used? With what results?

Cottonseed and stable manure are used to some extent in all the counties; guano, dissolved bone, and Charleston superphosphates are also generally used to a small extent. The results are always good. The correspondent from Hamilton says: "By proper application of cottonseed and stable manure, combined with a little lime and plaster, 600 pounds of cotton per acre can be produced upon land considered worn out."

7. Is green-manuring practiced? With what results?

With one or two exceptions green manuring is reported, but usually to a limited extent only. The green crop is mostly cow-peas, but occasionally rye, in the spring, and in clay *all* green vegetation; in Jefferson and Santa Rosa, "beggar lice" or Florida clover (*Richardsonia scabra*), along with cow-peas. There is no difference of opinion as to results; they are always good.

8. How is cottonseed disposed of? If sold, on what terms, or at what price?

Cottonseed is used to some extent in all the counties for manure and as feed for stock. Where a market is accessible, the bulk of the seed seems to be sold. The prices reported vary greatly—from 7 or 10 to 25 cents a bushel, or from $8 to $30 a ton. The upland or short-staple seed is less valuable, the relative values of the long and short staple being, in Suwannee county, $8 per ton for short- and $14 for long-staple seed.

9. Is cottonseed-cake used for feed? Is it used for manure?

In the counties near or accessible to oil-mills the seed-cake is used to some extent both as cow-feed and as manure, chiefly, however, as manure. For this purpose it is used sometimes alone, but is generally mixed with stable manure, muck, or phosphates. The counties where its use for feed or manure is reported are Gadsden, Suwannee, Columbia, and Taylor. It must, however, be stated that where two reports have been received from one county the answers are frequently conflicting.

30. To what cause is the trouble attributed by the farmers? What efforts have been made to obviate it? With what success?

Rust is thought by correspondents in Jackson, Gadsden, Columbia, and Alachua to be due to want of potash and vegetable matter in the soil. Fertilizing with barn-yard manure is considered almost a preventive by the correspondent from Columbia. In Jefferson, Suwannee, and Volusia rust is thought to be caused by excessive rains. Shedding is supposed by the correspondents from Jackson, Gadsden, Leon, Jefferson, Suwannee, Columbia, and Volusia to be due to extremes of seasons and defective cultivation The correspondent from Alachua thinks that shedding as well as rust may be prevented by resting the land and rotation of crops, so as to increase the amount of vegetable mold in the soil; also, deep careless plowing, by which the roots of the plant are cut, is often to blame. Shallow plowing in Gadsden has been deemed a remedy or preventive of shedding in Jackson and Gadsden. Late plowing has been tried in Suwannee as a remedy both for shedding and blight, and in some instances with fine success. No efforts have been made against the boll-worm; but Paris green has been tried against the caterpillar, and fires at night against the moth. Wet weather favors greatly the spread of the caterpillar.

31. Is rust or blight prevalent chiefly on heavy or ill-drained soils? Do they prevail chiefly in wet or dry, cool or hot seasons? On which soil described by you are they most common?

On ill-drained soils, especially sandy and sterile lands in Gadsden, Leon, Jefferson, Santa Rosa, Suwannee, Columbia, Clay, Hillsborough, Alachua, Marion, Taylor, and Volusia. Difference in the soil is not thought to have any effect in Jackson, Hamilton, and Sumter. Wet weather and hot season, or extremes either of wet or dry, or rainy season followed by a drought, are in every case looked upon as causes of these troubles.

32. Is Paris green used as a remedy against the caterpillar? If so, how, and with what effect?

In Jackson, Leon, Jefferson, Columbia, and Marion, to a small extent only. In the other counties reported as not used. In Leon, abandoned after few years trial as worthless. In Leon, applied mixed with flour, and with good results. In Jefferson, opinions differ as to value, the cotton is sometimes injured rather than benefited, and the danger to stock and to laborers is very great. The few experiments tried in Columbia proved beneficial, but rather expensive. In the manner in which the correspondent has seen it applied in Marion, it has a tendency to scald and kill the growing plant.

LABOR AND SYSTEM OF FARMING.

33. What is the average size of farms or plantations in your region? Is the prevalent practice "mixed farming" or "planting"?

In the upland counties, Jackson, Gadsden, Leon, and Jefferson, the farms are from 40 to 1,000 acres; in Gadsden the majority are 2-horse farms. In these four counties large farms are quite common. In the other counties the farms are small, varying in size from 10 to 150 acres, the majority being 80 to 120 acres. In Leon, Jefferson, and Marion, both "planting" and "mixed farming" are practiced, principally, however, "planting". In the other counties the prevailing pratice is "mixed farming".

34. Are supplies raised at home or imported? And, if the latter, where from? Is the tendency toward raising home supplies increasing or decreasing?

Part of the meat and nearly all the flour are imported; other supplies are to some extent raised at home, but different parts of the same county give different reports. In all cases, however, the tendency toward raising home supplies is generally increasing. Along the Gulf coast supplies are imported mostly from New Orleans; elsewhere the supplies come from Saint Louis, Cairo, Louisville, New York, and Savannah.

35. Who are your laborers chiefly? How are their wages paid? At what rates? When payable?

In the northern counties laborers are mostly negroes; further south native whites and negroes, the proportion of negro laborers decreasing southward. Wages are paid either in money, at the rate of $6 to $10 a month and rations, or 50 cents a day and board or 75 cents without board, or in part of the crop, which is generally one-half of the corn. The time of payment varies according to the contract. Payments are made by the day, week, month, and year, sometimes after sale of the first cotton. Yearly contracts are settled on the 1st of January; but the correspondents from Gadsden, Leon, and Alachua state that from 60 to 80 per cent. of the amount is usually advanced from time to time during the year.

36. Are cotton farms worked on shares? On what terms? Are any supplies furnished by the owners? Does your system give satisfaction? How does it affect the quality of the staple? Does the soil deteriorate or improve under it?

Jackson reports wages as the only system practicable in that county. The custom in all the other counties is to work on shares, except in Alachua, where the land is generally rented for a certain amount of cotton per acre. When the land-owner furnishes teams and implements he gets one-half the crop; when he furnishes all supplies in addition he gets two-thirds to three-fourths of the crop, according to contract. This system is reported as satisfactory, except in Gadsden, Leon, and Alachua, where it is considered only partially satisfactory. Jefferson says the negroes prefer this system, because by it they are able to do very nearly as they please.

The staple is thought by correspondents to be injured from Gadsden, Jefferson, Columbia, Clay, Alachua, for the reason that it is not promptly gathered.

The correspondents from Jackson, Leon, Marion, and Taylor observe no injury to the staple from this system. The soil deteriorates under the system because of constant drain without return; but correspondents from Suwannee, Hamilton, and Taylor do not observe any deterioration of the soil.

37. Which system (wages or share) is better for the laborer? What is the condition of the laborers? What proportion of negro laborers own land or the houses in which they live?

Gadsden, Leon, Jefferson, 1 Hamilton, 2 Columbia, Alachua, Marion, Sumter, Polk, and Volusia consider wages best for the laborer, since the laborer gets what he needs—direction and "following up"—and makes something; he runs no risk of accidents of weather, etc., and the laborer makes more than by the share system. By the latter system the laborer cannet be made to work steadily, and thus idles away more of his time. On the other hand, 2 Hamilton, 1 and 2 Suwannee, 1 Columbia, and Taylor believe the share system to be better for the laborer, and Jackson thinks the advantages about equal. As arguments in favor of the share system, it is thought that the laborer, if industrious, gets better pay, and that he can not spend his earnings as readily as he can money.

The condition of the laborer is reported as generally good by correspondents in Jackson, 1 and 2 Jefferson, 2 Hamilton, 2 Suwannee, 1 Columbia, 1 and 2 Clay, Hillsborough, Alachua, and Sumter, while those in Gadsden, Leon, 1 Hamilton, 1 Suwannee, 2 Columbia, Marion, and Polk consider the condition of the laborer to be very poor, as they are generally destitute and dependent. Jackson, Gadsden, Leon, Jefferson, Hamilton, 1 Suwannee, 2 Alachua, Marion, and Polk report a very small proportion only of the negro laborers own land or houses, not more than one-tenth, while 2 Suwannee, Columbia, Hillsborough, 1 Alachua, Sumter, and Volusia report over half the negro laborers as owning land and houses.

38. What is the market value of land described in your region? What rent is paid for such land?

No general statement of the market value of the lands can be given. It varies from $1 to $25, according to quality and locality. The poorer pine lands are worth from $1 to $3 per acre; uplands and hummocks from $5 to $25. The average rent charged for cleared and cultivated land is $1 50 per acre in money or one-fourth the crop, or 15 to 20 pounds of lint-cotton to the acre, or 500 to 1,000 pounds of lint for a 40-acre farm, according to locality of the land and the quality of the cotton. In some ocalities rent is as high as $3 an acre.

39. How many acres or 400-pound bales per hand is your customary estimate?

When other crops are cultivated the average long-staple is 2 to 3 bales to the hand and from 12 to 20 acres. In the upland counties from 6 to 8 bales to the hand and an average of about 15 acres.

40. To what extent does the system of credits or advances upon the growing crop prevail in your region?

In Jackson, Gadsden, Leon, Jefferson, Hamilton, Suwannee, Alachua, and Marion, and where cotton is the chief crop, the credit system prevails, and often to a ruinous extent, as in many cases the farmers are a year behind; the merchants are willing to advance on growing crops and take liens for heavy profits. No remedy seems possible under the present system of planting cotton exclusively. In the lower counties, Polk, Taylor, and Volusia, the credit system does not prevail to any great extent, cotton not being the chief crop.

41. At what stage of its production is the cotton crop usually covered by insurance? Is such practice general?

There appears to be no insurance on the cotton in any of the counties while it is in the producer's hands. It is insured when it reaches the market, not before; in some cases never.

42. What are merchants' commissions and charges for storing, handling, shipping, insurance, etc., to which your crop is subject? What is the total amount of these charges against the farmer per pound or 400-pound bale?

For the upland or short-staple cotton the charges are given at 1 cent a pound or $4 a bale in Jackson; 1¼ cents in Gadsden; nearly 2 cents in Leon; 1¼ cents a pound or $5 a bale in Jefferson; $2 50 to $3 50 a bale in Hamilton.

For the sea-island cotton, $7 to $7 50 a bale in Suwannee; $8 to $10 in Columbia; $5 to $7, or 2½ per cent., in Clay.

In Alachua, 16 cents per pound. One correspondent says: "Commissions, 2½ per cent.; insurance, $1 a bale per month; amount of *stealage*, uncertain, but perfectly sure to come."

Marion, Polk, and Volusia report about $5 a bale, and Taylor about $9.

43. What is your estimate of the cost of production in your region, exclusive of such charges, and with fair soil and management?

For short-staple cotton Jackson reports 7½ cents a pound; Gadsden, 7 to 10 cents; Leon, 6 to 8 cents; 1 Jefferson, 6 to 7 cents in a good year; in a bad year the farmer will come out in debt; 2 Jefferson, counting interest on investment and services of owner, it costs 10 to 12 cents a pound, otherwise about 8 cents; Hamilton, about $25 a bale.

Of the long-staple we have the following estimates: 1 Suwannee, about three-fourths of its value; 2 Suwannee, $15 to $20 a bale; 1 Columbia, "My opinion is that it costs at least 4 cents a pound in the seed"; 2 Columbia, 20 cents a pound; 1 Clay, 15 cents a pound; Hillsborough, "It is usually claimed that it costs more than it sells for, but it brings ready money"; 1 Alachua, 30 cents a pound; 2 Alachua, 16 cents a pound; Marion, not less than 20 cents a pound; Sumter, about one-half its market value. The others give no estimates.

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REPORT

ON THE

COTTON PRODUCTION OF THE STATE OF GEORGIA,

WITH A DESCRIPTION OF

THE GENERAL AGRICULTURAL FEATURES OF THE STATE.

BY

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SPECIAL AGENT.

[NORTHWEST GEORGIA BY A. R. McCUTCHEN, SPECIAL AGENT.]

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LETTERS OF TRANSMITTAL.

BERKELEY, CALIFORNIA, *January* 1, 1883.

To the SUPERINTENDENT OF CENSUS, *Washington.*

DEAR SIR: I transmit herewith a report on the cotton production and agricultural features of the state of Georgia, prepared by Dr. R. H. Loughridge, in accordance with the general plan approved by you.

You will observe that the proportion of counties from which replies to schedule questions have been received is very considerable, being one hundred and twelve out of one hundred and thirty-seven. This, together with the extended personal knowledge of the state possessed by Dr. Loughridge, has made the description more complete and detailed, and of course of correspondingly greater length than that of other states from which the returns have been less complete.

It should be fully understood by the public that the agricultural descriptions of states and counties given in connection with the cotton returns of the census make no pretensions to completeness, but only to correctness as far as they go; and even in the latter respect must, of necessity, in a considerable degree, depend upon the faithfulness of the reports received from those replying to schedule questions. We have taken all reasonable pains to secure both correctness and completeness so far as means would permit, and especially in so far as our efforts were seconded by the inhabitants of the regions concerned. We are conscious of the fact that our work is but the beginning of more complete industrial descriptions of the states to be perfected hereafter with the aid of those who appreciate the importance of thus setting before the world a fair and true exposition of the resources of their respective states.

Very respectfully,

EUG. W. HILGARD,
Special Agent in charge of Cotton Production.

Professor EUGENE W. HILGARD,
Special Agent in charge of Cotton Production.

DEAR SIR: I have the honor of submitting to you the following report on cotton culture in the state of Georgia, embracing also a general description of the state and its counties, made in accordance with your instructions.

In its preparation I have been largely assisted by data obtained from the records of the late state geological survey, to which I had access through the kindness of the commissioner of agriculture and of the former state geologist, Dr. George Little. Valuable information has also been obtained from Messrs. C. A. Locke and M. T. Singleton, formerly of the survey, but now of the corps of United States engineers engaged in river improvement in Georgia. My own connection with that survey has enabled me to add many items in the state's agricultural features of which the records make no note, and in this other members of the survey (Professor D. C. Barrow, of Athens, and A. R. McCutchen, of La Fayette) have assisted me. The largest part of the state had never been examined by the survey, and hence the lines marking the limits of agricultural regions are not absolutely correct in their detail. It is but justice to the corps to say that, so far as regards agricultural features, their instructions did not include more than mere cursory observations of the country passed over.

The northwestern part of the state, or "Northwest Georgia", as it is generally called, is well described by the special agent for that region, Mr. A. R. McCutchen, whose thorough knowledge of its geological and agricultural features has especially fitted him for the work. The descriptions of the counties of the region which appear in Part II were also prepared by him.

The schedules of questions on cotton culture prepared by you were sent to parties in each county in the state, and their answers have been made willingly, and, in most cases, fully, the writers often showing great interest in the work.

The publications of the Georgia department of agriculture have been of much service to me, and the officers of the department have freely given me any aid in their power.

To Messrs. G. R. Black, of Screven county; J. A. M. King, of Liberty county; S. M. H. Byrd, of Polk county, and C. A. Locke, then in Telfair county, I am indebted for samples of the soils of their respective regions for analysis.

This report is made after the plan of your report on Louisiana, dividing the subject-matter into the following parts, preceded by tables showing enumeration results:

Part I. A general description of the state, embracing its topographical, climatic, and agricultural features, and special descriptions of the agricultural divisions, with analyses of the chief soils.

More space is given to a general outline of the geology of the state than would seem to be justified by the leading objects of the report; but so little is known of this subject, which is of exceptional interest (because of the state's position between the Gulf and the Atlantic), that it has been thought well to dwell somewhat largely on the general formations.

A chapter on cotton production, as relating to agricultural regions and counties, the product per acre, etc., is included in this part.

Part II. Agricultural descriptions of counties, with abstracts of schedule answers from correspondents.

Part III. Details of cotton culture, and a summary of answers to questions on methods of culture, diseases and insect enemies, system of labor, etc., as given by correspondents in very many of the counties throughout the state.

In conclusion, I would express to you my deep sense of obligation for the very material aid you have given me in outlining this report, and the care and interest you have taken in its revision.

Very respectfully,

R. H. LOUGHRIDGE.

TABULATED RESULTS OF THE ENUMERATION.

TABLE I.—AREA, POPULATION, TILLED LAND, AND COTTON PRODUCTION.
TABLE II.—ACREAGE AND PRODUCTION OF LEADING CROPS.

TABLE I.—SHOWING AREA, POPULATION, TILLED LAND, AND COTTON PRODUCTION.

Counties.	Land area.	POPULATION.						TILLED LAND.		COTTON PRODUCTION.						Cotton acreage per square mile.	Bales per square mile.
		Total.	Male.	Female.	White.	Color'd.	Average per square mile.	Acres.	Per cent. of area.	Per cent. of tilled land.	Acres.	Bales.	Average per acre.				
													Bale.	Seed-cot'n.	Lint.		
	Sq. mls.											475 *lbs.*		*Lbs.*	*Lbs.*		
The State	58,980	1,542,180	762,981	779,199	816,906	725,274	26	7,690,292	20.4	34.03	2,617,138	814,441	0.31	444	148	44.4	13.8
NORTHWEST GEORGIA.																	
Murray	420	8,269	4,130	4,139	7,362	907	20	42,494	15.8	13.97	5,937	1,917	0.32	459	153	14.1	4.6
Whitfield	330	11,900	5,861	6,039	9,689	2,211	36	44,199	20.9	9.20	4,068	1,240	0.30	435	145	12.3	3.8
Catoosa	160	4,739	2,396	2,343	4,127	612	30	24,600	24.0	1.49	367	111	0.30	432	144	2.3	0.7
Walker	440	11,056	5,506	5,550	9,492	1,564	25	69,756	24.8	8.31	5,797	2,009	0.35	495	165	13.2	4.6
Dade	180	4,702	2,645	2,057	3,618	1,084	26	17,148	14.9	0.19	32	12	0.38	534	178	0.2	0.1
Chattooga	400	10,021	4,837	5,184	7,981	2,040	25	50,802	19.8	25.40	12,906	5,247	0.41	579	193	32.3	13.1
Gordon	360	11,171	5,523	5,648	9,347	1,824	31	69,467	30.2	12.48	8,668	3,301	0.38	543	181	24.1	9.2
Floyd	540	24,418	12,082	12,336	14,958	9,460	45	96,479	27.9	31.73	30,615	14,545	0.48	678	226	56.7	26.9
Polk	330	11,952	6,139	5,813	7,805	4,147	36	54,233	25.1	30.93	16,774	8,126	0.48	690	230	50.8	24.6
Bartow	500	18,690	9,130	9,560	12,419	6,271	37	88,231	27.6	24.90	21,969	10,111	0.46	657	219	43.9	20.9
Total	3,660	116,918	58,249	58,669	86,798	30,120	32	557,409	23.8	19.22	107,133	46,619	0.44	621	207	29.3	12.7
METAMORPHIC REGION.																	
Blue Ridge counties.																	
Rabun	400	4,634	2,243	2,391	4,437	197	12	18,209	7.1	0.25	43	14	0.31	444	148	0.1	.....
Towns	180	3,261	1,655	1,596	3,157	104	18	14,198	12.3	.....	.....	.....	.....	.....	.....	.....	.....
Union	330	6,431	3,211	3,220	6,321	110	19	30,347	14.4	0.04	12	5	0.42	594	198	.....	.....
Fannin	390	7,245	3,568	3,737	7,112	133	19	27,197	10.9	.....	.....	.....	.....	.....	.....	.....	.....
Gilmer	480	8,386	4,135	4,251	8,258	128	17	30,273	9.9	0.40	122	32	0.26	375	125	0.3	0.1
Pickens	230	6,790	3,253	3,537	6,645	145	30	26,834	18.2	8.24	2,210	734	0.33	474	158	9.6	3.2
Dawson	180	5,837	2,797	3,040	5,479	358	32	24,958	21.7	8.77	2,189	850	0.39	552	184	12.2	4.7
Lumpkin	290	6,526	3,223	3,303	6,075	451	23	21,019	11.3	1.28	269	109	0.41	576	192	0.9	0.4
White	180	5,341	2,655	2,686	4,751	590	30	19,889	17.3	1.15	228	68	0.30	426	142	1.3	0.4
Habersham	400	8,718	4,374	4,344	7,357	1,361	22	28,365	11.1	6.21	1,762	597	0.34	483	161	4.4	1.5
Total	3,060	63,169	31,064	32,105	59,592	3,577	21	241,289	12.3	2.83	6,837	2,409	0.35	501	167	2.2	0.8
Middle Georgia counties.																	
Franklin	330	11,453	5,718	5,735	8,906	2,547	35	61,117	28.9	27.65	16,901	5,723	0.34	483	161	51.2	17.3
Hart	330	9,094	4,480	4,614	6,212	2,882	28	39,759	18.8	37.53	14,923	5,094	0.34	486	162	45.2	15.4
Banks	320	7,337	3,624	3,713	5,830	1,507	23	31,261	15.3	26.39	8,251	2,960	0.36	510	170	25.8	9.2
Hall	540	15,298	7,506	7,702	13,040	2,258	28	64,981	18.8	18.84	12,245	5,133	0.42	597	199	22.7	9.5
Forsyth	250	10,559	5,137	5,422	9,072	1,487	42	53,042	33.2	22.85	12,121	5,044	0.42	594	198	48.5	20.2
Milton	110	6,261	3,090	3,171	5,484	777	57	30,629	43.5	32.61	9,989	4,490	0.45	642	214	90.8	40.8
Cherokee	470	14,325	7,061	7,264	12,699	1,626	30	63,289	21.0	21.71	13,739	5,615	0.41	582	194	29.2	11.9
Haralson	330	5,974	2,985	2,989	5,821	153	18	28,225	13.4	17.22	4,860	2,035	0.42	597	199	14.7	6.2
Paulding	340	10,887	5,465	5,422	9,903	984	32	52,654	24.2	30.69	16,158	7,352	0.46	648	216	47.5	21.6
Cobb	400	20,748	10,202	10,546	14,734	6,014	52	88,578	34.6	30.76	27,250	13,092	0.48	684	228	68.1	32.7
Fulton	200	49,137	23,470	25,667	28,295	20,842	246	38,735	30.3	25.91	10,038	4,285	0.43	609	203	50.2	21.4
De Kalb	280	14,497	7,173	7,324	9,954	4,543	52	60,023	33.5	32.18	19,318	8,008	0.41	591	197	69.0	28.6
Gwinnett	470	19,531	9,630	9,901	16,016	3,515	42	96,582	32.1	28.52	27,549	11,810	0.43	612	204	58.6	25.1
Jackson	360	16,297	8,149	8,148	11,139	5,158	45	67,109	29.1	37.07	24,874	9,482	0.38	543	181	69.1	26.3
Madison	300	7,978	3,885	4,093	5,392	2,586	27	51,716	26.9	25.19	13,029	4,918	0.38	537	179	43.4	16.4
Elbert	440	12,957	6,485	6,472	6,085	6,872	29	79,406	28.2	32.53	25,833	8,826	0.34	486	162	58.7	20.1
Oglethorpe	510	15,400	7,687	7,713	5,469	9,931	30	92,772	28.4	38.06	35,306	12,336	0.35	498	166	69.2	24.2
Clarke	180	11,702	5,465	6,237	5,313	6,389	65	23,337	20.3	34.37	8,020	3,310	0.41	588	196	44.6	18.4
Oconee	160	6,351	3,143	3,208	3,327	3,024	40	34,223	33.4	35.95	12,303	4,257	0.35	492	164	76.9	26.6
Walton	400	15,622	7,820	7,802	9,321	6,301	39	82,628	32.3	38.48	31,797	12,534	0.39	561	187	79.5	31.3
Rockdale	120	6,838	3,434	3,404	4,149	2,689	57	33,529	43.7	43.09	14,448	4,385	0.30	432	144	120.4	36.5
Clayton	140	8,027	3,957	4,070	4,938	3,089	57	39,995	44.6	43.56	17,422	6,606	0.38	540	180	124.4	47.2
Campbell	240	9,970	5,085	4,885	6,085	3,885	42	61,411	40.0	34.93	21,448	8,986	0.42	597	199	89.4	37.4
Douglas	190	6,934	3,421	3,513	5,463	1,471	36	29,330	24.1	32.46	9,520	4,099	0.43	615	205	50.1	21.6
Carroll	540	16,901	8,407	8,494	14,591	2,310	31	85,683	24.8	26.37	22,593	9,300	0.41	588	196	41.8	17.2
Heard	290	8,769	4,362	4,407	5,674	3,095	30	47,761	25.7	36.32	17,348	5,900	0.34	486	162	59.8	20.3
Coweta	440	21,109	10,457	10,652	9,305	11,804	48	116,956	41.5	41.46	48,494	16,282	0.34	477	159	110.2	37.0
Fayette	220	8,605	4,255	4,350	5,742	2,863	39	59,278	42.1	36.75	21,787	7,131	0.33	465	155	99.0	32.4
Spalding	220	12,585	6,166	6,419	5,439	7,146	57	53,335	37.1	43.00	22,935	7,418	0.32	462	154	104.3	33.7
Henry	400	14,193	7,056	7,137	7,961	6,232	35	73,583	28.7	48.56	35,730	10,930	0.31	435	145	89.3	27.3
Newton	260	13,623	6,760	6,863	6,740	6,883	52	65,039	39.1	42.75	27,801	7,796	0.28	399	133	106.9	30.0
Morgan	400	14,032	6,884	7,148	4,249	9,783	35	82,315	32.2	42.81	35,243	7,358	0.21	297	99	88.1	18.4
Greene	340	17,547	8,693	8,854	5,573	11,974	52	91,224	41.9	43.89	40,037	12,448	0.31	444	148	117.8	36.6

TABLE I.—SHOWING AREA, POPULATION, TILLED LAND, AND COTTON PRODUCTION—Cont'd.

Counties.	Land area.	POPULATION.						TILLED LAND.		COTTON PRODUCTION.						Cotton acreage per square mile.	Bales per square mile.
		Total.	Male.	Female.	White.	Color'd.	Average per square mile.	Area.	Per cent. of area.	Per cent. of tilled land.	Acres.	Bales.	Average per acre.				
													Bale.	Seed-cot'n.	Lint.		
METAMORPHIC REGION—cont'd.																	
Middle Georgia counties—Continued.	*Sq. mls*											475 *lbs.*			*Lbs.*	*Lbs.*	
Taliaferro	180	7,034	3,514	3,520	2,312	4,722	39	46,616	40.5	30.16	14,058	4,758	0.34	483	161	78.1	26.4
Wilkes	460	15,985	7,958	8,027	5,173	10,812	35	88,776	30.2	34.80	30,891	11,109	0.36	513	171	67.2	24.2
Lincoln	286	6,412	3,132	3,280	2,254	4,158	23	37,813	21.1	33.85	12,798	3,861	0.30	429	143	45.7	13.8
Columbia	290	10,465	5,243	5,222	3,030	7,435	36	54,362	29.3	46.54	25,302	8,313	0.33	468	156	87.2	28.7
McDuffie	330	9,449	4,808	4,641	3,430	6,019	29	54,381	25.7	45.64	24,819	7,439	0.30	426	142	75.2	22.5
Warren	290	10,885	5,443	5,442	4,039	6,846	38	53,966	29.1	46.31	24,991	7,885	0.32	447	149	86.2	27.2
Hancock	520	16,989	8,471	8,518	5,044	11,945	33	99,397	29.9	43.63	42,773	15,010	0.35	501	167	82.3	28.9
Putnam	360	14,539	7,203	7,336	3,518	11,021	40	72,664	31.5	49.29	35,819	9,678	0.27	384	128	99.5	28.9
Baldwin	240	13,806	6,776	7,030	4,512	9,294	58	61,464	40.0	45.28	27,832	7,921	0.28	405	135	116.0	33.0
Jones	470	11,613	5,775	5,838	3,753	7,860	25	70,928	23.6	42.04	29,820	8,297	0.28	396	132	63.4	17.7
Bibb	240	27,147	12,759	14,388	11,429	15,718	113	52,179	34.0	39.72	20,724	5,858	0.28	405	135	86.4	24.4
Jasper	380	11,851	5,963	5,888	4,258	7,593	31	67,203	35.9	31.66	27,606	6,741	0.24	348	116	72.6	17.7
Butts	180	8,311	4,095	4,216	4,277	4,034	46	49,090	42.6	42.28	20,755	6,829	0.33	468	156	115.3	37.9
Monroe	470	18,808	9,372	9,436	6,693	12,115	40	106,673	35.5	42.17	44,979	13,354	0.30	423	141	95.7	28.4
Pike	290	15,849	7,852	7,997	7,780	8,069	55	93,620	50.4	41.40	38,755	12,431	0.32	456	152	133.6	42.8
Upson	310	12,400	6,115	6,285	6,133	6,267	40	72,475	36.5	42.15	30,551	8,540	0.28	399	133	98.6	27.5
Crawford	340	8,656	4,305	4,351	3,940	4,716	25	53,531	24.6	46.24	24,754	6,765	0.27	390	130	72.8	19.9
Talbot	360	14,115	7,071	7,044	4,448	9,667	39	74,037	32.1	49.04	36,310	10,325	0.28	405	135	100.9	28.7
Meriwether	490	17,651	8,754	8,897	7,797	9,854	36	124,118	39.6	40.02	49,676	15,154	0.31	435	145	101.4	30.9
Troup	430	20,565	10,187	10,378	6,595	13,970	48	129,046	46.9	51.29	66,188	18,655	0.28	402	134	153.9	43.4
Harris	470	15,758	7,797	7,961	6,450	9,308	34	91,989	30.6	46.97	43,203	12,677	0.29	417	139	91.9	27.0
Muscogee	210	19,322	8,906	10,416	8,995	10,327	92	44,718	33.3	26.00	11,625	3,268	0.28	402	134	55.4	15.6
Total	18,110	748,151	368,701	379,450	393,781	354,370	41	3,508,551	31.0	37.80	1,363,539	449,811	0.33	471	157	75.3	24.8
CENTRAL COTTON BELT.																	
Richmond	320	34,665	16,025	18,640	17,185	17,480	108	36,626	17.9	21.49	7,871	2,742	0.35	495	165	24.6	8.6
Burke	1,030	27,128	13,579	13,549	6,089	21,039	26	228,886	34.7	38.17	87,359	29,172	0.33	477	159	84.8	28.3
Jefferson	620	15,671	7,968	7,703	5,581	10,090	25	123,924	31.2	33.38	41,377	13,377	0.32	462	154	66.7	21.6
Glascock	100	3,577	1,811	1,766	2,506	1,071	36	25,124	39.3	22.54	8,175	2,635	0.32	459	153	81.8	26.3
Washington	680	21,964	10,784	11,180	9,449	12,515	32	152,887	35.1	43.76	66,900	23,058	0.34	492	164	98.4	33.9
Laurens	740	10,053	5,065	4,988	5,702	4,351	14	89,834	19.0	23.03	20,689	6,863	0.33	474	158	28.0	9.3
Wilkinson	440	12,061	5,995	6,066	6,550	5,511	27	101,049	35.9	25.16	25,423	7,966	0.31	447	149	57.8	18.1
Twiggs	330	8,918	4,477	4,441	2,844	6,074	27	67,050	31.7	44.25	29,671	8,217	0.28	396	132	89.9	24.9
Pulaski	470	14,058	7,057	7,001	5,824	8,234	30	83,762	27.8	38.29	32,074	9,805	0.31	435	145	68.2	20.9
Houston	560	22,414	11,108	11,306	6,024	16,390	40	160,827	47.4	42.76	72,611	19,099	0.26	375	125	129.7	34.1
Taylor	400	8,597	4,216	4,381	4,770	3,827	21	44,770	17.5	40.35	18,064	4,854	0.27	384	128	45.2	12.1
Marion	360	8,598	4,310	4,288	4,294	4,304	24	77,951	33.8	27.68	21,579	6,109	0.29	408	136	59.9	17.1
Chattahoochee	220	5,070	2,821	2,849	2,130	3,540	26	38,457	27.3	40.15	15,442	4,460	0.29	411	137	70.2	20.3
Stewart	440	13,998	6,972	7,026	4,376	9,622	32	107,251	38.1	41.44	44,449	12,653	0.28	405	135	101.0	28.8
Webster	230	5,237	2,542	2,695	2,667	2,570	23	43,762	29.7	39.38	17,235	4,642	0.27	384	128	74.9	20.2
Schley	180	5,302	2,612	2,690	2,229	3,073	29	38,931	33.8	49.17	19,143	4,945	0.26	369	123	106.4	27.5
Macon	360	11,675	5,743	5,932	4,288	7,387	32	67,593	29.3	46.88	31,687	8,334	0.26	375	125	88.0	23.1
Sumter	520	18,239	8,888	9,351	6,050	12,189	35	104,664	31.4	42.22	44,190	11,451	0.26	369	123	85.0	22.0
Lee	360	10,577	5,324	5,253	1,739	8,838	29	99,449	43.2	35.89	35,694	9,143	0.26	366	122	99.2	25.4
Terrell	320	10,451	5,188	5,263	4,268	6,183	33	58,844	28.7	43.74	25,740	6,944	0.27	384	128	80.4	21.7
Randolph	400	13,341	6,431	6,910	5,545	7,796	33	91,249	35.6	37.48	34,204	8,467	0.25	354	118	85.5	21.2
Quitman	160	4,392	2,181	2,211	1,773	2,619	27	25,584	25.0	46.18	11,815	3,163	0.27	381	127	73.8	19.8
Clay	200	6,650	3,222	3,428	2,798	3,852	33	53,952	42.2	39.92	21,539	4,576	0.21	303	101	107.7	22.9
Calhoun	280	7,024	3,468	3,556	2,354	4,670	25	57,804	32.3	42.26	24,429	4,670	0.19	273	91	87.2	16.7
Dougherty	340	12,622	6,242	6,380	1,952	10,670	37	85,885	39.5	47.73	40,996	9,736	0.24	339	113	120.6	28.6
Early	510	7,611	3,749	3,862	3,015	4,596	15	42,276	13.0	48.61	20,552	4,270	0.21	297	99	40.3	8.4
Total	10,570	320,493	157,778	162,715	122,002	198,411	30	2,117,391	31.3	38.67	818,898	231,411	0.28	402	134	77.5	21.9
SOUTHERN OAK, HICKORY, AND PINE UPLANDS.																	
Decatur	1,160	19,072	9,399	9,673	8,889	10,183	16	79,219	10.7	37.25	29,509	6,396	0.22	309	103	25.4	5.5
Thomas	780	20,597	10,162	10,435	8,384	12,213	26	89,760	18.0	39.90	35,895	8,773	0.24	348	116	46.0	11.2
Brooks	530	11,727	5,822	5,905	5,670	6,057	22	75,962	22.4	27.98	21,255	6,288	0.30	423	141	40.1	11.9
Total	2,470	51,396	25,383	26,013	22,943	28,453	21	244,941	15.5	35.38	86,659	21,457	0.25	354	118	35.1	8.7

TABLE II.—ACREAGE AND PRODUCTION OF THE LEADING CROPS OF THE STATE—Continued.

Counties.	COTTON.		INDIAN CORN.		OATS.		WHEAT.		SWEET POTATOES.	
	Acres.	Bales.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.
LONG LEAF PINE AND WIRE-GRASS REGION—cont'd.										
Pine barrens division.										
Johnson	11,705	3,823	14,288	87,413	1,826	15,084	404	1,616	359	28,360
Montgomery	2,356	852	10,231	84,375	4,904	36,218	142	495	347	42,080
Emanuel	10,749	3,669	24,300	195,694	3,957	32,110	950	4,033	539	63,037
Bulloch	9,140	3,724	15,394	134,222	7,661	71,880	15	65	597	64,473
Effingham	1,767	686	9,337	72,619	2,096	18,930	.....	.....	293	28,756
Tattnall	2,618	964	10,991	96,189	4,802	36,954	8	67	722	68,147
Wayne	331	119	4,243	39,112	2,188	15,506	.....	.....	427	52,016
Appling	1,069	379	6,816	56,573	4,097	31,594	.....	.....	379	36,042
Coffee	1,825	591	6,925	58,408	5,450	44,760	.....	.....	648	71,406
Telfair	2,228	740	6,302	49,942	2,032	15,658	.....	.....	240	27,826
Wilcox	5,278	1,831	7,804	61,511	3,086	20,711	6	32	377	33,071
Irwin	1,800	595	4,049	38,391	3,319	29,114	.....	.....	473	59,706
Berrien	5,583	2,008	8,429	80,681	8,199	89,166	15	128	567	84,680
Pierce	994	369	4,105	39,026	2,209	21,786	.....	.....	439	45,770
Total	57,443	19,350	133,214	1,094,156	55,826	479,471	1,540	6,436	7,066	705,364
PINE FLATS AND COAST COUNTIES.										
Ware	524	158	3,388	29,184	1,953	14,376	.....	.....	343	33,663
Clinch	1,622	511	5,524	48,995	3,359	26,623	.....	.....	302	36,559
Echols	3,578	731	5,159	30,873	1,650	11,918	.....	.....	156	13,269
Charlton	258	62	1,960	16,763	684	3,597	.....	.....	179	16,968
Camden	206	68	3,195	29,792	138	1,343	.....	.....	370	38,733
Glynn	58	10	1,565	17,546	241	2,415	.....	.....	299	28,968
McIntosh	339	104	2,825	34,463	354	4,197	.....	.....	514	40,060
Liberty	2,084	679	8,565	74,041	3,597	27,178	.....	.....	962	74,038
Bryan	764	304	5,000	38,248	1,786	14,409	.....	.....	273	26,967
Chatham	289	65	2,224	26,763	619	9,128	20	300	758	49,777
Total	9,722	2,692	39,425	346,668	14,381	115,184	20	300	4,147	358,952

PART I.

PHYSICO-GEOGRAPHICAL AND AGRICULTURAL FEATURES OF THE STATE OF GEORGIA.

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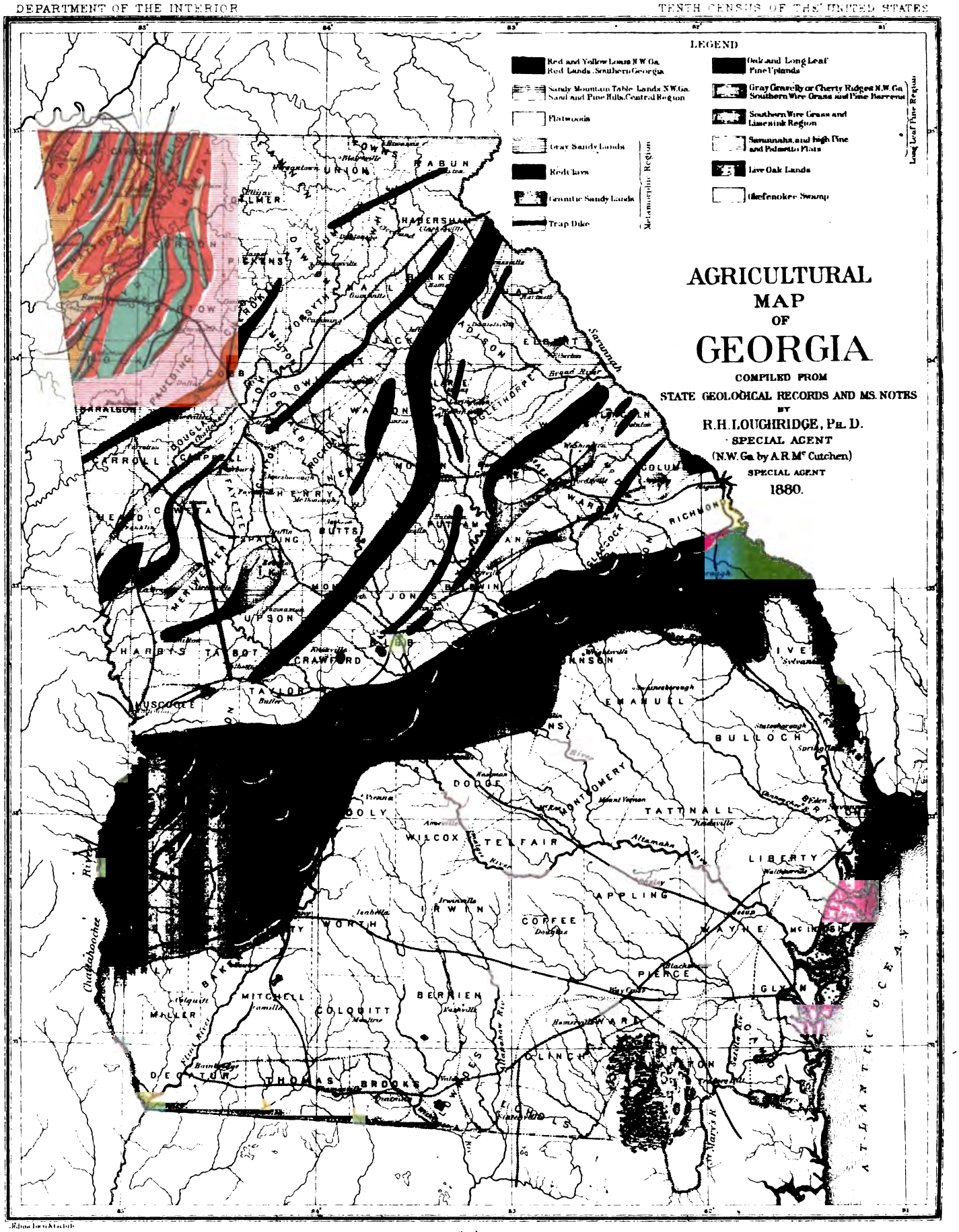

LEGEND
Red and Yellow Loam N.W. Ga.
Red Lands, Southern Georgia
Sandy Mountain Table Lands N.W.Ga.
Sand and Pine Hills, Central Region
Flatwoods
Gray Sandy Lands
Red Clays
Granitic Sandy Lands
Trap Dike
Metamorphic Region
Oak and Long Leaf Pine Uplands
Gray Gravelly or Cherty Ridges N.W. Ga.
Southern Wire Grass and Pine Barrens
Southern Wire Grass and Limestone Region
Savannahs, and high Pine and Palmetto Flats
Live Oak Lands
Okefenokee Swamp
Long Leaf Pine Region
AGRICULTURAL
MAP
OF
GEORGIA
COMPILED FROM
STATE GEOLOGICAL RECORDS AND MS. NOTES
BY
R.H. LOUGHRIDGE, Pa. D.
SPECIAL AGENT
(N.W. Ga. by A.R. Mc Cutchen)
SPECIAL AGENT
1880.
Scale
25 0 25 50 75 100 MILES

GENERAL DESCRIPTION OF THE STATE OF GEORGIA.

The state of Georgia lies between longitude 3° 47′ 21″ and 8° 42′ west from Washington, and between latitude 30° 21′ 39″ and 35° north, embracing in its area 59,475 square miles, of which 495 square miles is water surface, embracing 150 square miles of coast waters (bays, gulfs, sounds, etc.), 300 square miles consist of rivers and smaller streams, and 45 square miles of lakes and ponds. The land area is therefore 58,980 square miles. There are 137 counties in the state.

TOPOGRAPHY.—The northwestern corner of the state is crossed from Tennessee to Alabama by several ranges of mountains that rise in altitude from 500 to 1,000 feet above the intervening broad and rich valleys. Sand and Lookout mountains are broad-backed, while the other ranges are mostly narrow or "backbone" ridges. In the northeastern portion of the state is the Blue Ridge chain, with other isolated points, rising high above the surrounding country. The Chattahoochee ridge, an offshoot from this, and forming the Atlantic and Gulf water-divide, passes south of the Chattahoochee river, soon losing its prominence as a ridge and falling in elevation to Atlanta. Southward the country is more generally level or rolling, sometimes hilly, with but few low mountains until the pine lands are reached; thence to the coast the fall is very gradual and the lands very level. These features are described more in detail under each agricultural region.

CLIMATE.—The state, with its southern boundary resting against Florida and in part washed by the Atlantic ocean on the southeast, its northern boundary 320 miles to the north among the mountains of the Blue Ridge and the Cumberland range, and nearly 5,000 feet above sea-level, presents an average temperature of 68° F. on the coast, 52° to 56° in middle Georgia, and 52° in the Blue Ridge region, or an annual average of about 65° for the entire state.

The average rainfall for the state is from 46 to 50 inches, the steady rains being usually brought by southeastern winds.

The coast region, with its sea breezes and "salty atmosphere", has a mean winter temperature of about 48°, the lowest being rarely below 32°. Its summer maximum is 90° and the mean 79°. Its rainfall is about 57 inches, December and January being the driest months.

So genial is the climate of the coast counties that oranges, bananas, and other semi-tropical fruits are produced in abundance. The markets of colder states are supplied with very early vegetables and garden luxuries from the farms of this region.

In middle Georgia the rainfall is less (41 inches), the driest months being June and September. The yearly temperature ranges from 6° to 96°, with an average of 44° in winter and 73° in summer. During the hottest summer days the temperature often rises to 100°, but the nights are cool, pleasant, and invigorating.

In northeastern Georgia the extremes of temperature are 6° and 90°, with an average of 43° for the winter months and 75° for the summer. The rainfall for this section is about 57 inches, heavy rains occurring in the fall and winter months. The amount of rain that annually falls in each section and in the wet and the dry months varies greatly.

Snow falls in northern Georgia every winter, but only to depths of from 2 to 4 inches, and remains but a short time. In middle Georgia it frequently falls, but melts almost as rapidly as it touches the ground. Occasionally, on ridges, it reaches a depth of an inch or two. In southern Georgia snow is rarely seen.

High winds, mostly accompanied by thunder storms, prevail chiefly in the spring and early summer, and come from the southwest, occasionally becoming tornadoes.

Planting in the low or southern country begins as early as March 15, and fall frosts do not appear earlier than December 1, and it often happens that there is no frost during the winter.

In northern Georgia planting is not done until about the last of April, because of continued cold and frosty weather.

GEOLOGICAL FEATURES.—The geological formations represented in Georgia embrace the Metamorphic, the Palæozoic, the Triassic, Cretaceous, Tertiary, and Quaternary. Their full and detailed examination had not been

made when the state geological survey (from the records of which this description is taken) was suspended, and hence the data are not sufficient for a full outlining of each group. This is especially the case in the southern counties. The description of the Palæozoic, by Mr. McCutchen, appears under the head of "Northwest Georgia", page 19.

Metamorphic.—The metamorphic region embraces the broad area of crystalline rocks in the middle and northern part of Georgia. This is claimed by many eminent geologists to be the oldest formation of the state (Archæan), while others contend that the series of strata are but the changed Silurian groups (chiefly Quebec and Cincinnati), and therefore newer than the northwestern Palæozoic region.

The commonly-occurring rocks of the series are the well known feldspathic granites and gneisses, hornblendic gneisses and schists, mica-schists, sandstones, soapstones, etc., of the Appalachian region. These form strata of varying thickness, but seldom of uniform character, and are intercepted and crossed by quartz veins, large and small, and by numerous trap dikes, which are greatly disintegrated and form the local soils. They inclose a large variety of minerals (gold being the most prominent ore), especially in the counties of Habersham, White, Cherokee, Cobb, and Carroll. The following are the principal features of the region:

Adjoining the Palæozoic region (northwest Georgia) is a nearly continuous series of short mountain ranges, the more prominent of which present bold fronts toward that region. These are composed of metamorphic and semi-metamorphic rocks, and have a southerly trend from the Tennessee line through Murray into Bartow county, and thence westerly through the southern part of Polk into Alabama, *across the strike of the Palæozoic formations*. Their relation to the latter is given by Mr. McCutchen in his report on that section of the state.

The Blue Ridge mountains, on the northeast, are formed most generally of gray feldspathic gneisses, some of their offshoots being hornblendic. The rocks of the section present a greater variety than in any other portion of the metamorphic, aluminous and magnesian minerals being very prevalent and entering largely into their composition. Their strike is very generally to the southwest. Tallulah mountain, one of the offshoots forming the boundary-line between Habersham and Rabun counties, is composed principally of sandstone of great thickness, which extends over a part of Habersham, and is found also in Gilmer and in other counties.

Southward from the Blue Ridge and sandstone regions to the Chattahoochee river are broad belts of very generally disintegrated gneisses and gold-bearing mica-schists having multitudinous quartz veins and a general strike southwest across the state to Alabama. This is "the gold belt" of Georgia.

On the northeast a series of magnesian rocks, embracing stratum of limestone, apparently overlies these schists. The limestone has an irregular thickness of from a few inches to several feet, is non-fossiliferous in character, and contains small deposits of galena. It passes from South Carolina through Habersham and Hall counties, its last known outcrop being near Buford, in Gwinnett county. These strata dip to the southeast.

While the various strata enter the state from South Carolina with very regular southwesterly strikes, and those that pass into Alabama on the west have also the same regularity, this is not preserved through Georgia, deflections occurring on both sides of a large central granite region, which deflections are greatest on the east, where the belts pass south nearly to the sand-hills before resuming their southwesterly strike. The line connecting the points where these deflections begin on the east would pass from the mountains of Fannin and Gilmer counties (which have a southeasterly trend at right angles to the Blue Ridge) southeast to Hancock county, on the southern edge of the metamorphic. This line is parallel with the Savannah river, the various trap dikes, the greater part of the main water-divide of the state, and the Florida peninsula, and also marks the eastern edge of the Oconee and Ocmulgee basin.

On the eastern side of the state the gray gneisses prevail with belts of granitic outcrops, all having southwestern trends. In Franklin county hornblendic gneiss covers nearly the entire county, but afterward, in its southern deflection through Jackson, Clarke, Oconee, Morgan, and other counties, its width is much contracted, and biotite gneiss, with some mica-schists, are intermingled with it.

In the western part of the state gray gneisses and mica-schists again predominate, the hornblendes occurring only in very narrow belts, except in the counties of Carroll and Troup, where their width is great enough to make definite areas of red land.

The agricultural divisions of the metamorphic, as marked out on the map, show very well the general outline of the strikes of the rocks, except in the northwest, where the general prevalence of "gray sandy lands", without intermixture of the "red belts", prevents the representation of the southerly strikes that occur along the eastern border of the Palæozoic of northwestern Georgia.

The Chattahoochee river, in its course through the metamorphic region, has also marked the general strike of the rocks of the section through which it flows, for it lies between the strata throughout almost all of its length, bending around with them to West Point, on the west of the granite region, but afterward cutting across them to Columbus. Occasionally it has been turned across some stratum that offers but little resistance, but it soon again resumes its course with them.

The central granite region, above alluded to, is a prominent feature of the metamorphic division of the state. Its area is narrow on the northeast, becomes very wide on the south of Atlanta, again narrow on the southwest, and continues thence southward to Thomaston, in Upson county, and how much farther is not definitely known.

Pine mountain, which forms a part of the southern boundary of Meriwether county, is a high ridge, composed mainly of heavy-bedded sandstone, dipping north 15° west. It is overlaid on the north by talcose slates and a stratum of itacolumite (very flexible at Warm Springs), which branches off to the northeast in the eastern part of the county. The anticlinal of this sandstone ridge is found a few miles to the south, forming Oak mountain (which terminates abruptly on the west near Hamilton, in Harris county), while between the two ridges there is a broad valley, in which are outcrops of granites and quartz masses. The trends of these ridges present but little irregularity to the eastward until Flint river is crossed, when Pine mountain turns abruptly northward and seems to be broken up into a number of sandstone hills with no regularity of position, while Oak mountain is lost in a rough and broken country.

On the east of the state, as well as along the southern border of the metamorphic, are other granitic areas, terminating, so far as known, near the Oconee river, the large belt of stratified gneisses and schists passing southward between them and the central granite region. The granites along the southern border of the metamorphic differ from those mentioned in having coarse crystals of a pink feldspar and in being more highly siliceous, and hence less subject to disintegration.

Triassic.—This formation probably includes the trap dikes of the metamorphic region, and also the clay slates that occur along its border. The trap dikes are most numerous on the east of the central granite region, but beyond the fact that they are apparently the same in character throughout and have the same general strike of north 15° west are not deserving of special mention, being with one or two exceptions small and not continuous. On the west of the granite region there occurs the largest dike in the state. Beginning in the northern part of Coweta county, it passes slightly east of south through Meriwether, and, cutting its way barely through the top of Pine and Oak mountains, continues, via Talbotton, to the sand-hills near Geneva, in the southern part of Talbot county. Its width is several hundred feet, and its outcrop is continuous and accompanied by occasional granite bowlders. Its course, as well as that of nearly all the other dikes, is parallel with the main Atlantic and Gulf water-divide from Atlanta southward.

Along the lower line of the metamorphic *clay slates* are occasionally found resting directly upon the gneisses, and are unconformable to them both in strike and dip, the latter being almost vertical. So far as known, they cover but a small area in the state.

The border region of the metamorphic.—This region is characterized on the surface by sand-hills, which overlie clays and sands, the accumulation of the disintegrated material of the metamorphic rocks, as shown by the beds of kaolin, associated with mica and occasional pieces of feldspar, hornblende, and other minerals, and also by the pink clays found just below the falls of Chattahoochee river at Columbus. These pink clays also underlie the town of Gerard, on the Alabama side. The metamorphic strata suddenly disappear along almost the entire line, and wells dug 75 or 100 feet deep, in valleys whose level is below that of the metamorphic and not a great distance from it, fail to strike them.

The region is from 10 to 15 miles wide, lying between the metamorphic on the one side and the Cretaceous and Tertiary hills on the other. Its altitude is from 400 to 600 feet above tide (highest between Macon and Milledgeville) and from 200 to 400 feet above the river. The sand-hills are most prominent along the line of the metamorphic—often much higher than the adjoining portions of that region—and fall in elevation to the foot of the Cretaceous and Tertiary hills on the south. Ferruginous sandstone caps the hills, but water-worn drift pebbles are found only along the streams, the beds gradually thinning out as they recede from them. The belt is mostly a long- and short-leaf pine region with scrub undergrowth, though there are occasional isolated spots of red lands of the Tertiary found mostly along its northern limit, which are apparently but the remnants of what were once continuous beds. Thick beds of a conglomerate of coarse grit, mica, clay, kaolin, and the very friable "recomposed granite" of Lyell occur all along the belt, outcropping either on hillsides or in the beds of streams and underneath the sands.

In brief, it would seem that the Cretaceous and Tertiary beds that probably once occupied the western and eastern portions, respectively, had been simultaneously washed away by drift floods, leaving here and there a few isolated high points (as at Rich Hill, Houston county), and that in the trough thus formed there had subsequently been deposited these great beds of clays and sands, with thickness and height greatest along the immediate metamorphic border. Yet this view is not without its difficulties, for in many localities we find the sand-hills rising suddenly high above the metamorphic border, and either sloping gradually southward to the general surface of the Tertiary, oak, hickory, and pine region (as in Taylor county), or to the foot of a bluff (75 or 100 feet high) of exposed strata of Tertiary limestone marls and clays.

Cretaceous.—This formation covers but a comparatively small area in Georgia on the west, and is the eastern termination of that broad belt which forms so prominent an agricultural feature of middle Alabama and northeastern Mississippi. On the Chattahoochee river it reaches from Columbus southward to a point one mile south of the mouth of Pataula creek, in Clay county. From this point the eastern limit of exposure is along that creek northeastward to the mouth of Hodchodkee creek, and thence northward into Stewart county, 6 miles west of Lumpkin, the county-seat; thence it bends around eastward, passing 7 miles north of Lumpkin and 5 miles north of Ellaville, to the northeast corner of Schley county, where the formation disappears.

In its surface features it differs from the region in the other states in a total absence of the black prairies and of any outcrop of the rotten limestone. The beds are covered almost throughout by red clays and deep white sand, forming a rolling and well-timbered country. Passing southward along the river, from the metamorphic rocks at Columbus, we find, at first, beds of plastic and purple clays (exposed only for a short distance). Near the mouth of Upatoi creek, 8 miles south of Columbus, blue micaceous sands and clays form abrupt bluffs along the river for a number of miles, and, dipping to the southwest at a slight angle, are overlaid by heavy and yellow clays more or less fossiliferous, and probably the representatives of the rotten limestone group. At Georgetown, Quitman county, and thence to the border of the Tertiary, the highly fossiliferous beds of blue marl and thin ledges of limestone of the Ripley group are exposed along the river bank and preserve the same slight southwest dip. Their most interesting point of exposure is at the "narrows" of Pataula creek, in Clay county. The most valuable feature of the Cretaceous marls is the bed of greensand clays which outcrops in the bluff of the river, 25 feet thick, for a distance of 15 or 20 miles from Rood's bluff, in the southwestern corner of Stewart county. The marls of the formation are not rich in lime, though some contain many fragments of bone, and especially of the large fossil turtle, *Emys*, the shells of two of which, almost entire, were found near Chimney bluff, Stewart county.

Tertiary.—The Tertiary beds underlie the rest of southern Georgia, and are covered largely by the Quaternary deposits of sands and clays on the south and east. The geological group most largely represented is the Eocene; but the Miocene and Pliocene also occur on the southeast. The Claiborne, Jackson, and Vicksburg groups of the Eocene are all present, but their different areas have not been fully defined as yet.

Eocene: The rock found directly overlying the Cretaceous marls on the Chattahoochee river is the white limestone of the Claiborne group, which outcrops along the banks of the river for many miles south of Fort Gaines, and has a slight dip to the southwest. The rock is at first hard and compact, but in the upper portion is very friable, and is composed largely of fine corals. Over it, as seen in the bluff at Fort Gaines, are blue and yellow fossiliferous clays, with some lignite, and finally a deposit of red clayey loam 50 feet thick, containing in places siliceous fossils. The age of both clay and loam is unknown.

Section of bluff at Fort Gaines, Clay county.

Red loam	feet..	50
Layer of *Ostrea compressirostra* (?)	inches..	18
Light yellow-clay marl, with a few broken fossils	feet..	15
Blue, compact, pyritous clay	do...	8
The same with casts of fossils	do...	2
Blue fossiliferous and compact clay marl	do...	25
Clay, with nodules	do...	4
Yellowish shell marl	do...	3
White friable limestone or marl, with ledges of hard limestone, disappearing below the water	do...	15

This lower bed of limestone extends across the state, outcropping probably with the Vicksburg beds at Silver and Shell bluffs, on the Savannah river, as well as on the banks of all the larger streams and in exposed bluffs. Its northern limit is marked by that of the oak, hickory, and pine division on the agricultural map.

The following section of strata at Shell bluff, on the Savannah river, near the Boggy Gut creek, Burke county, was taken by Mr. M. T. Singleton, formerly of the state survey:

Section at Shell bluff, Burke county.

1.	Red-loam hill-tops	feet..	15 to 25
2.	White sandy marl, coarse sand, and oysters, *O. Georgiana*	feet..	10
3.	Coarse drift and shell fragments	feet..	2
4.	Shell bed, *O. Georgiana*	feet..	13
5.	White sandy marl	feet..	60
6.	Indurate marl, with casts of small shells	feet..	2
7.	White sandy marl	feet..	6
8.	Indurate marl, with casts of shells and few *Ostrea sellæformis*	feet..	3
9.	Hard yellowish white marl	feet..	4
10.	Oyster bed, *O. sellæformis*	feet..	1
11.	Hard marl	feet..	5
12.	Oyster bed, *O. sellæformis*	inches..	6
13.	Hard yellowish-white marl	feet..	10
14.	Fine yellowish sandy marl	feet..	6
15.	Yellowish-white clay marl	feet..	2
16.	Indurate marl, with shells	feet..	2
17.	Whitish-gray clay marl (to water)	feet..	15

The upper portion of this bluff, which contains the *Ostrea Georgiana* beds, is of the Vicksburg group, while the lower portion, including perhaps stratum No. 5, is of the Cleburne. The intermediate Jackson has not been recognized.

Pliocene: The savanna region along the coast, which occupies the first terrace at an elevation of from 10 to 15 feet above tide-water, is assigned to the Pliocene formation. Marls or shell beds of this age are found on the Savannah river near the Effingham and Chatham county-lines.

On Satilla river a white marl bed outcrops at Burnt Fort, the head of tide-water, which is mostly devoid of fossils.

In the sand and clay beds of this coast region, in Glynn, Chatham, and other counties, have been dug up the remains of extinct gigantic quadrupeds, such as the mastodon, and along its borders are the buried stumps of cypress and other trees still standing upright. Live oak is a prominent growth of the region adjoining the marshes.

Quaternary or southern drift.—This formation consists of irregular deposits of sands and clays and ferruginous sandstones over the older strata. In Georgia they are confined exclusively to the southern half of the state, the belt of sand-hills or metamorphic border region being the most northerly deposit as well as the main representative body of drift in the state. Exclusive of this belt, they are heaviest on the western side of the state, especially over Clay, the upper parts of Randolph, Webster, Sumter, and counties north of these. The sands are white and deep, and overlie variegated clays, mostly plastic. To the south these beds occur now and then, but are not so prominent.

On the east of the water-divide the drift beds are confined almost entirely to the oak, hickory, and pine division, or Eocene territory. There are a few isolated sand and pebble beds in the pine barrens, and beds of white sand, with a scrub growth, have been observed on the eastern side of some of the streams in the region. One of these, two miles wide, occurs on the eastern side of Alligator creek, in Montgomery county, about 25 feet above the stream, and lying parallel with it.

DRAINAGE.—It will be seen by a glance at the map that all of the rivers of the southern three-fourths of the state flow south or southeastward, while across their headwaters the Chattahoochee river has a course at right angles to them southwestward from near the North Carolina line, on the northeast, to Alabama. North of the Chattahoochee basin the course of the stream is generally westward.

Two general divisions are recognized, viz, the Atlantic and the Gulf, with their respective tributaries. The divide between these two is formed at first by the Blue Ridge as it enters the northeastern corner of the state; then, as it turns south and southwestward, it follows Tallulah mountain and Chattahoochee ridge along the south side of the Chattahoochee river to Atlanta; thence it turns southeastward across the granitic area between the tributaries of the Flint and Ocmulgee rivers to Irwin county, and thence between the headwaters of the Satilla and Withlacoochee rivers (here near each other), in Irwin county, to the region of the Okefenokee swamp, in Clinch, where the country is very level. All the streams that enter this swamp on the north unite and form the Suwanee river, which flows out on the western side. The divide proper extends thence eastward along the north of the swamp, then turns abruptly south, forming a low sand ridge along its eastern side, and then again bends southwestward around the headwaters of the Saint Mary's river into Florida (to "Trail's ridge"), thus forming the north, east, and south rims to the swamp basin.

The courses of the two streams, the Satilla and Saint Mary's, are peculiar. They flow in nearly parallel eastward directions for a short distance on the north and south of the swamp, then suddenly turn and approach each other on the same line to within a few miles, and as suddenly and abruptly turn to the ocean.

This Atlantic and Gulf water-divide is not properly a ridge throughout its length, but as a general rule is only a slightly elevated region with a somewhat rolling surface, whose ascent is so gradual that its importance in the drainage system of the state would not be suspected. The area occupied by the Gulf shed is the larger, covering about three-fifths of the state.

The streams of the Atlantic water-shed are very regular in their parallel courses southeastward, each having its own system of tributaries and emptying independently into the ocean, excepting the Oconee and Ocmulgee, which unite to form the Altamaha. The Savannah basin is very narrow, especially on the south.

The Gulf water-shed comprises a number of different river systems. The *Tennessee basin*, included between the Blue Ridge on the southeast and the mountains of Fannin and Gilmer counties, comprises an area of 850 square miles. On the southern slope of the Blue Ridge the two distinct basins of the Chattahoochee and Etowah rivers have their heads side by side with but a narrow ridge between, the former trending southward for a short distance and suddenly turning westward, while the latter lies along the foot of the ridge westward to Rome, where it unites with the Coosawattee basin, from which it has been separated by the continuation of the Blue Ridge. These two streams form the head of the *Coosa basin*, whose area in Georgia comprises 6,020 square miles. This includes the Tallapoosa River division, which in Georgia is distinct and separated from the main basin by the Dug Down, Kenesaw, and Sweat mountains and intervening uplands.

The *Chattahoochee basin* has a greater length than any other in the state—nearly 450 miles. Its head is in the corner formed by the Blue Ridge and the Tallulah mountains, and thence it extends across the metamorphic region in a southwesterly course to West Point, with a width very narrow, sometimes only 15 miles, thence southward to the Gulf. The ridge separating it from the Etowah and the Tallapoosa basins is so low as to be almost imperceptible, and the tributaries of each basin interlock very generally. On the south it is separated from the Atlantic water-shed by the main water-divide, which approaches very near the river, until it turns southward from Atlanta. Here, however, the Chattahoochee ridge, which to this point is the chief divide, continues in the same southwestward course to Newnan, in Coweta county, and thence, turning southeastward and parallel to the former,

forms the western rim to the Flint River basin as far south as the sand-hills. Thence southward the basin of the Chattahoochee is very narrow, while that of the Flint is wide, draining the largest part of the territory of the southwest.

NAVIGATION.—The Savannah river has long been open to light-draught steamboat navigation as far north as the shoals near Augusta. A canal 9 miles in length connects with the river above the shoals, and flat-boats laden with cotton and other produce are thus enabled to reach the city from the counties northward as far as the mouth of Broad river, a distance of 100 miles, or 350 miles from Savannah.

The Ogeechee river is navigable but for a short distance from the coast. The Altamaha is the largest river of the state; steamers run regularly as far northward as the Central railroad bridge on the Oconee, in Washington county, and to Hawkinsville, Pulaski county, on the Ocmulgee, each about 340 miles from Darien.

The Chattahoochee river is navigable to the falls at Columbus, Muscogee county. The channel is being deepened and improved in the removal of the marl beds and other obstructions north of Eufaula by United States engineers. Steamboats ascend Flint river as high as Albany, Dougherty county.

Saint Mary's river is navigable as far as Traders' Hill, and the Satilla to Burnt Fort, the heads of tide-water. Lumber, rosin, and turpentine are the chief exports by sloops from stations along these streams.

The Coosa, in Georgia, is all navigable, and boats ascend the Oostanaula, its tributary, 105 miles from Rome.

The islands along the coast afford safe and good coasting facilities between Savannah and Florida ports.

Tide-water reaches inland along the various streams from 20 to 40 miles, and large vessels easily reach the city of Savannah.

LAND DIVISIONS.—The proprietary land divisions of Georgia, being different from those of other states, the following, from the *Hand-Book of Georgia*, is given as a matter of interest:

Head-rights.—Originally in Georgia land was held in what was called in law "tail male", but this policy was changed at an early period. An act was passed in 1777 for opening a land-office and to encourage immigration, granting to every free white (the head of a family) 200 acres of land, and 50 acres for each member of the family (including negroes), not exceeding ten in number. This was the first *head-right* law; but the war of the Revolution being then in progress, it failed of its purposes.

In 1780 it was renewed, and the land-office was located in Augusta. After the war much of the legislation had reference to thus settling the state.

The head-right country includes all the territory south of Franklin, Banks, and Jackson counties and east of the Oconee river, and was all acquired from the Indians before the Declaration of Independence.

Indian treaties.—After the revolutionary war the remaining portions of the state were acquired by successive treaties made by the federal government with the Indians, the northwestern part being finally acquired in 1819. The land thus acquired was distributed by successive lotteries among the free white male citizens of the state over eighteen years of age. Every such citizen who had not previously drawn, was entitled to one ticket; if a husband or father, to two tickets; and certain officers and soldiers, to two. Widows and orphans were included in the distribution.

The lands taken up by head-rights were wholly irregular in form, each man pursuing his own taste in shaping the land selected and varying the lines to include the best lands. The remaining portions of the state distributed under the lottery system were regularly surveyed and divided into sections and subdivisions of districts and lots.

The details of the division of lands under successive lotteries from 1805 to 1833, and in different districts, varied considerably. The lots for each ticket had 202½ acres more frequently than any other number. Some districts were divided into lots of 490 acres each, while still others were divided into lots of 250 acres each. In the seventh lottery, in 1833, the lots were 160 acres each; and in the eighth, known as the Gold lottery, in which lands in the mineral region were distributed, the lots were 40 acres each.

AGRICULTURAL FEATURES.—The state is naturally divided into the following agricultural regions and their respective subdivisions, which will be separately described in detail:

I. Northwest Georgia:
   1. Gray sandy lands of the metamorphic border.
   2. Flatwoods.
   3. Red-clay lands.
   4. Gray siliceous soils of the ridges.
   5. Brown and red loams.
   6. Yellow-clay lands.
   7. Sandy table or mountain lands.
   8. Alluvial lands.

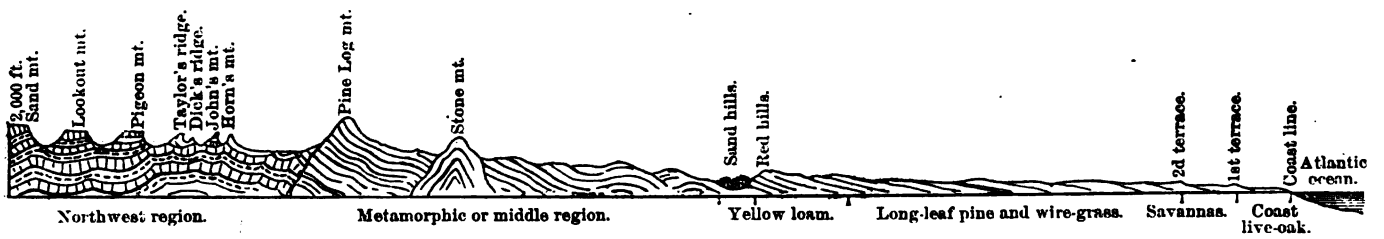
II. Metamorphic or mineral region (Blue Ridge or northern, middle and southern):
   1. Gray sandy lands.
   2. Red lands.
   3. Gray granitic lands.
   4. Flatwoods.

III. Central cotton belt.
   1. Sand and pine hills, or border region.
   2. Oak, hickory, and pine uplands.
   3. Red-clay hills.

IV. Long-leaf pine and wire-grass region.
   1. Limesink or clay lands.
   2. Sandy pine barrens.
   3. Pine and palmetto flats.

V. Coast region.
   1. Savanna lands.
   2. Live-oak and coast lands.

To give a general idea of the state in brief, before entering upon the detailed descriptions, the following section is given from the coast to the northwestern corner, accompanied by a short description of the country passed over:



Section showing elevation from the northwestern corner of Georgia to the Atlantic ocean. Distance about 375 miles. Altitude of Pine Log mountain, 2,347 feet.

GENERAL VIEW OF THE STATE.—The islands cover a width of 10 or 12 miles, with sand-hills seaward and marshes and live-oak lands inland. On the mainland the marshes, with live-oak lands, extend back for a few miles to the open savanna belt, which occupies the first terrace above the coast marshes and is a level plain, covered with palmetto and long-leaf pine, and interspersed with bay and gum swamps. Uniformity in character exists for 10 or 15 miles to the foot of the second terrace. This rises from 15 to 25 feet, and with it the wire-grass region begins. Its surface, at first undulating, has an open growth of long-leaf pine, with little or no undergrowth, except wire-grass. These pine barrens extend northwestward about 100 miles, and gradually rise to the altitude of 365 feet. As we pass northward over this region the loamy soils become perhaps more sandy, though still firm, and the country becomes somewhat more rolling, the monotony being varied only by cypress ponds, gallberry flats, and occasionally by a stream with its annually overflowed bottoms.

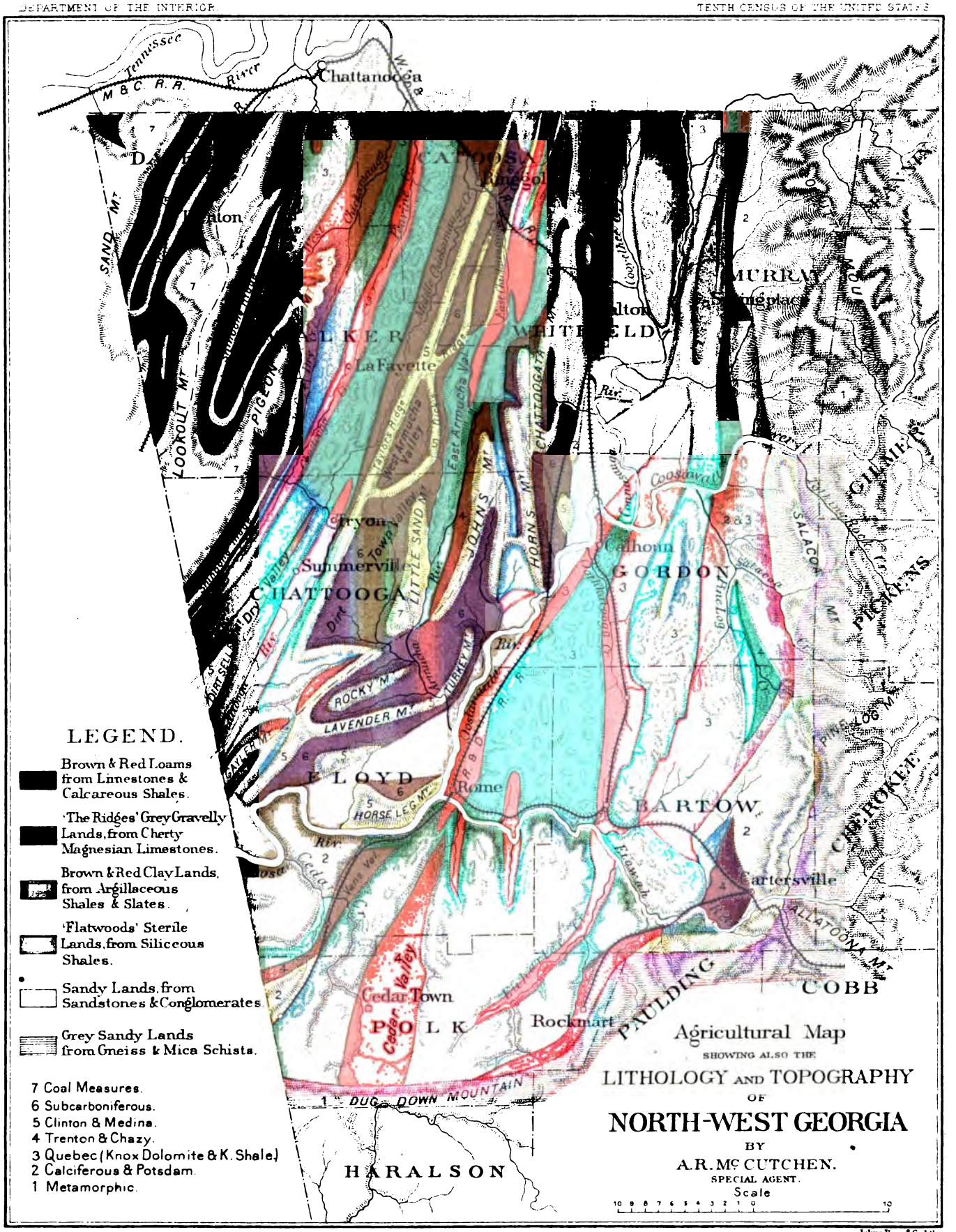
The central cotton belt, or yellow loam region, is to the northward. Long-leaf pine is at first most prominent, but gradually thins out to the north, being replaced by the short-leaf variety. The surface of the country, level at first, becomes more and more rolling, and buhrstone lies in fragments on the ground, limestone crops out in the streams, and wire-grass disappears entirely. Oak and hickory are prominent.

The soil, sandy at first, with yellow clay subsoil, becomes more clayey northward; the country also rises to an elevation of 500 feet, and in some places to 600 feet, to the summits of the red clay hills (150 miles from the coast), a rise of over 150 feet in 30 miles. Still northward from this yellow loam and oak uplands belt the sand and pine hills, with their pine and black-jack, are crossed. At first the land is lower than that of the red hills, but rises to a line of hills from 500 to 600 feet above the sea. Red clay lands, isolated, and similar to those on the south, are found on the northern edge of the belt, which here is only from 12 to 15 miles wide. The three divisions form parallel belts, and extend from the Savannah to the Chattahoochee river diagonally across the state.

With the northern edge of the belt last described the metamorphic or mineral division of the state begins, and presents a rolling, broken, and often hilly surface. Soils varying from gray sandy to red clayey, gravelly and rocky, occur in belts of every width, and rocks peculiar to the section, hornblendic and gray gneiss, outcrop in place or are found in fragments on the surface.

The growth is of great variety, the chief trees being oaks, hickory, chestnut, poplar, and pine. The elevation gradually increases toward the broad central granite region and beyond to Atlanta, where the altitude is 1,050 feet above the sea, and on Stone mountain 1,686 feet. Thence the country falls to 760 feet at the Chattahoochee river; but from there the altitude increases, until it reaches a maximum of 2,347 feet on Pine Log mountain, on the eastern side of Bartow county, and at the northwestern border of the metamorphic region, in all about 125 miles from the sand-hills. On the northeast the rise from the Chattahoochee river is still greater to the top of the Blue Ridge, a maximum of 4,796 feet, and thence falls to the Tennessee line, a distance of about 150 miles from Macon, on the southern border.

Bordering the metamorphic on its northwestern limit are ranges of hills having various names and a general trend southward from the Tennessee line to the Etowah river and the southeastern corner of Bartow county, and thence westward to the Alabama line. These ranges are metamorphic in character, and are higher than the northwestern



Julius Bien & Co lith.

Georgia region, not excepting its mountains. From the tops of these ranges we overlook the region popularly known as "Northwest Georgia", whose surface is prevalently characterized by abrupt ridges (mostly synclinal), consisting of folded Palæozoic rocks, varying from sandstones, shales, and cherts to limestones, with a general trend south-southwest and with broad agricultural valleys.

NORTHWEST GEORGIA. (a)

The region of northwest Georgia extends from the Cohutta, Pine Log, Allatoona, and Dug Down mountains to the Alabama and Tennessee state lines, and embraces an area of 3,360 square miles, including the counties of Dade, Walker, Catoosa, Whitfield, Murray, Gordon, Chattooga, Floyd, Bartow, and Polk. The lands, usually well characterized by the geological formations to which they belong, are found to change and alternate at every few miles in crossing the trend of mountains and valleys, and these changes are usually quite apparent in the natural growth of the country and in the color, relative fertility, and adaptation of soils. The great variety of soils, together with a diversity of climate, due to the varying altitudes of this country, render it suitable for the successful culture of perhaps every agricultural product of the temperate climate.

TOPOGRAPHY.—The country is banded by a number of mountains, ridges, and valleys, extending with a general parallelism in an approximate northeast and southwest direction, approaching nearest to north and south in the eastern part of the division, and with divergent mountains running nearer to east and west in the southern and central portions. Sand, Lookout, and Pigeon mountains, in the northwestern corner of the state, are synclinal table-lands belonging to the Alleghany coal-field. These vary in altitude from 800 to 1,200 feet above the adjacent valleys, and are usually trough-shaped on the top, having somewhat elevated borders along their brows and precipitous sides, marked by perpendicular sandstone bluffs. These mountains have an area on the top of rolling and often nearly level sandy lands amounting in the aggregate to 200 square miles. Lookout mountain is separated from Sand mountain on the northwest by Lookout valley, which has a width of 3 or 4 miles, and extends from Alabama across this part of the state into Tennessee. Pigeon mountain is an easterly spur of Lookout mountain, giving rise to a V-shaped valley, which widens out toward the north, and is known as McLemore's cove. These mountains are bordered throughout most of their extent by steep sandstone ridges of from 100 to 300 feet in height, giving rise to narrow valleys around their bases. These ridges are a constant feature of the table-land mountains, and occur everywhere in this relation to them, except where they have disappeared by erosion. About the central portion of Pigeon mountain, where the table-land feature is lost with the disappearance of the sandstones and conglomerates from its summit, the ridges on each side merge into the main mountain, and with it form the broken and knobby region terminating the range. These are known in Walker and Chattooga counties as shinbone ridges, and in Dade county as pudding ridges.

East of Lookout and Pigeon mountains, at distances of from 10 to 20 miles, is another series of mountains extending nearly centrally across this division of the state. These are mostly sharp topped, and have altitudes of from 500 to 1,000 feet above the surrounding valleys. White Oak mountain, Taylor's ridge, and Gaylor mountain extend in a direct line across this part of the state, only separated from each other by narrow gaps. To the east of these mountains, either in interrupted parallel ranges or divergent spurs belonging to the same system of elevations, are Dick's ridge, Rocky Face, Chattoogata, Horn's, John's, Little Sand, Rocky, Lavender, and Horse Leg mountains. Little Sand mountain and Rocky mountain are table-lands of small extent belonging to the Coosa coal-field. The surrounding sharp-crested mountains here bear the lithological relation to these table-lands that the shinbone and pudding ridges, before described, bear to Sand, Lookout, and Pigeon mountains on the northwest.

Next on the east are the Cohutta, Salicoa, Pine Log, Allatoona, and Dug Down mountains, constituting a single range, and extending around the eastern and southern boundary of this division of the state, being, in fact, the eroded escarpment of an elevated plateau that lies to the southeast of this region. This feature of the range is quite apparent in Polk county, where the brow of the escarpment is but 500 or 600 feet above the valleys on the northwest and corresponds to the general level of the country to the south; but in the northern part, especially in the Cohutta mountains, where the altitude is much greater, it is cut up by coves and ravines, so that mountains are encountered in all directions for a distance of 10 or 15 miles between the base and the summit of the escarpment.

To recapitulate: The ranges in this division of the state may be designated by the most prominent mountains of each, as (1) the Lookout range, on the west; (2) the Chattoogata range of the central portion of this region; and (3) the Cohutta range, on the eastern and southern border. Intermediate between these mountains are a number of chert and sometimes sandstone ridges, rarely exceeding 200 or 300 feet in height. The sandstone ridges are generally narrow, while the cherty ones form knobby belts of from 1 mile to 10 miles in width. These alternate with shale and limestone valleys, thus subdividing the areas between the mountains into somewhat narrow belts, with topographical and agricultural features varying with these lithological characters. The valleys range in altitude from 500 or 600 to 1,000 feet above the sea, the elevation being greatest about the divide between the waters of the Tennessee river on the north and the Coosa river on the south.

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a The description of Northwest Georgia, from pages 19 to 29, is by A. R. McCutchen, of La Fayette, Walker county, special agent, formerly assistant state geologist.

WATER-DIVIDE.—The water-divide extends in a zigzag line across both mountains and valleys from about the southeastern corner of Dade across the county of Walker, and to the northern line of Whitfield, where it passes into the state of Tennessee. There is a general depression in the level of the country toward the southwest from this divide corresponding in direction with the trend of the mountains, while the fall in the direction of drainage toward the north to the Tennessee is confined to the valleys in which the streams flow, the mountains in general maintaining about the same elevation above the sea. The streams near the water-divide have a fall of from 20 to 40 feet per mile, but this decreases rapidly as they approach the Tennessee and the Coosa rivers.

Most of the valleys, and generally those of greatest width, belong to anticlinal folds, and owe their present dimensions, if not their existence as valleys, to extensive erosion that has followed the folding and elevation of the strata. Along some of these folds the existing rocks indicate the removal of at least 10,000 feet of strata; but the erosion in synclinal valleys has not gone to so great an extent, and in some of these there is evidence of the disappearance over considerable areas of about 1,500 feet of strata.

CLIMATE.—The annual mean temperature in this part of the state varies, according to locality, from about 50° to 60° F. The regions of lowest temperature are about the Cohutta mountains, in the northeast, and on the table-lands in the northwest, where the altitudes range from 1,800 to 3,000 feet above the sea, and that of the highest temperature in the valleys of the southern and central portions. This difference of climate is due, in part, to a difference of about one degree of latitude between the northern and the southern limits of the region, but in a much greater degree to the general features of the country, mainly to the difference of altitude, and again to the general direction of the slope, which is toward the south in the central and most of the southern portions, and toward the north in the northwestern and northeastern portions. These influences all combine to give a warmer climate to most of the valleys drained by the Coosa river and its immediate tributaries.

In the extremes of temperature the thermometer seldom rises above 90° F. in the summer or falls below 20° in the winter. Vegetation usually starts some time in March, and there is a difference of about a week in this respect between the more northern and the more southern counties, giving to the latter an earlier time for planting and a somewhat longer crop season. Severe frosts rarely occur after the first of April, and about six months usually elapse between the latest frosts in the spring and the earliest in autumn. Ridges and mountain slopes of 100 feet or more in altitude above the valleys are free to a greater or less extent from spring frosts, and are less subject to cold dews in spring and summer. For this reason the fruit crop seldom fails in such situations.

The climate of the table-lands differs in several particulars from that of the valleys, being much more uniform and having a lower mean temperature. From the following table a comparison may be made for the month of July, 1880. The observations were made at stations about four miles distant from each other:

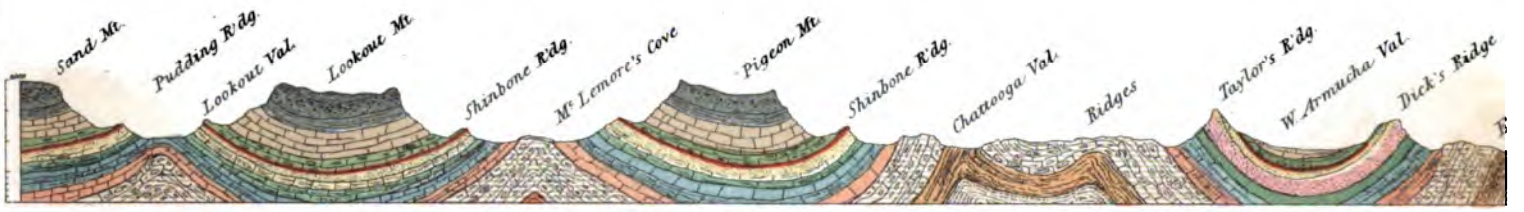
	Height above the sea.	THERMOMETER.							
		Mean.	Range.			Mean of—			
			Maximum.	Minimum.	Difference.	7 a. m.	2 p. m.	9 p. m.	Daily range.
	Feet.	*Degrees.*	*Degrees.*	*Degrees.*	*Degrees.*	*Degrees.*	*Degrees.*	*Degrees.*	*Degrees.*
Dry Creek valley	967	77½	95	61	34	71	87	75	16
Pigeon mountain	1,968	74½	88	63	25	70	80½	73	10½
Difference	1,001	3	7	2	9	1	6½	2	5½

The Smithsonian rain charts indicate for this part of the state a mean precipitation of rain amounting for the summer to 10 inches and about the same for the winter months, with 40 inches for the entire year. The amount of rain, however, varies very much in different seasons, and also to some extent with the local features of the country, the heavier precipitations, as well as the greater number of rainfalls, occurring usually in the vicinity of the larger mountains.

During the fall, winter, and spring months continued southeast winds are usually accompanied within a few hours by clouds, and are commonly followed within thirty-six hours by a fall of rain. These rain spells often continue through two or three days of cloudy weather, with either occasional showers, or else slow and constant or drizzling rains. Rain clouds from this direction are generally dispersed by westerly or northwesterly winds, and the clearing off is usually preceded by brisk showers, accompanied by gusts of wind. Snow clouds, unlike the rain clouds in winter, come from a northwest direction. Snows, however, are comparatively unusual, and the winter season very often passes without a snowfall that lies on the ground. A snow of six inches depth, or one that covers the ground for more than two or three days in the valleys, is unusual; but on the mountains snows are somewhat more frequent.

Southeasterly winds in the summer season are not so commonly accompanied by rain clouds as in the cooler portions of the year, but the vapor with which the atmosphere is charged, mainly from this source, is condensed

DEPARTMENT OF THE INTERIOR



SECTION

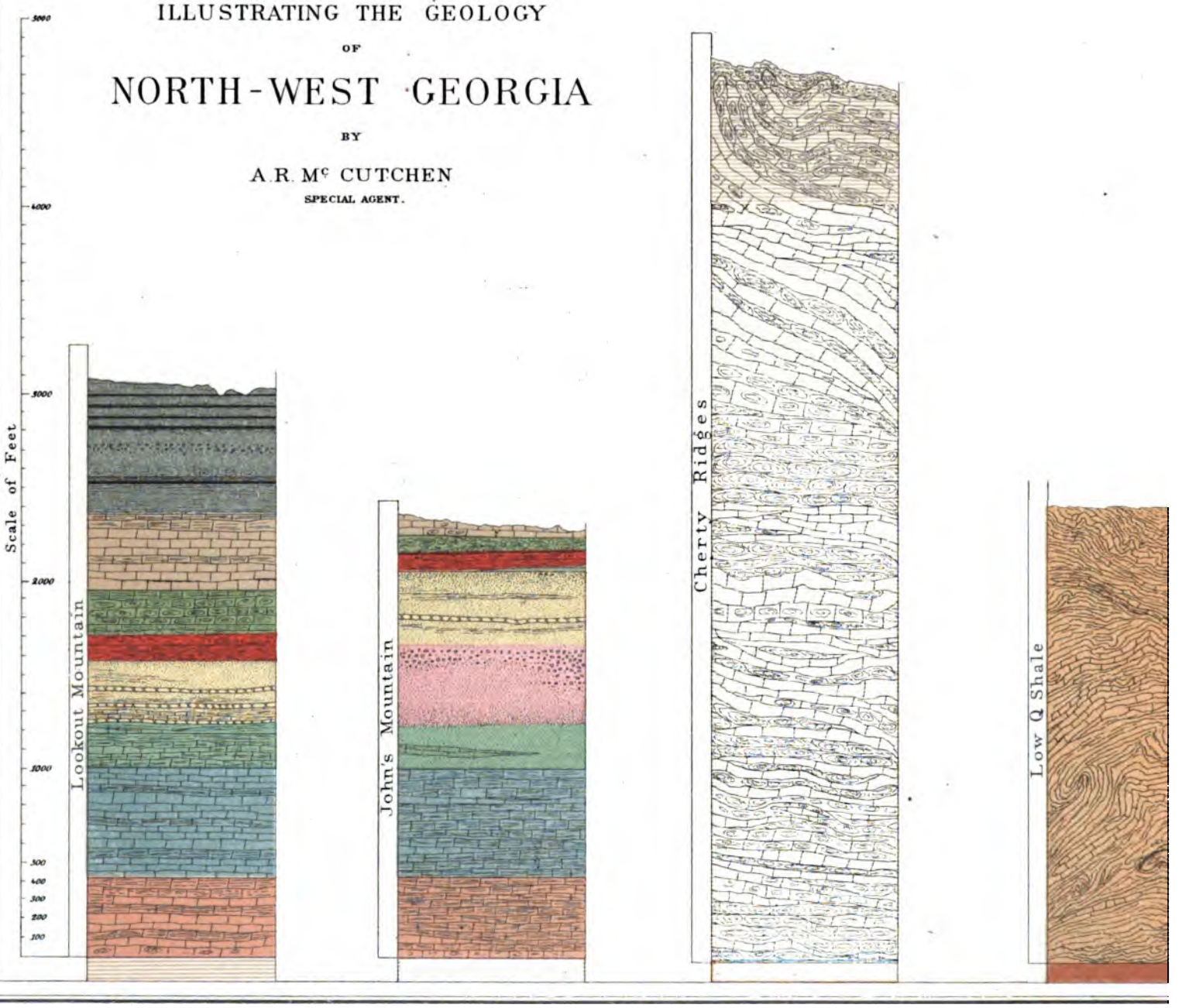
ILLUSTRATING THE GEOLOGY

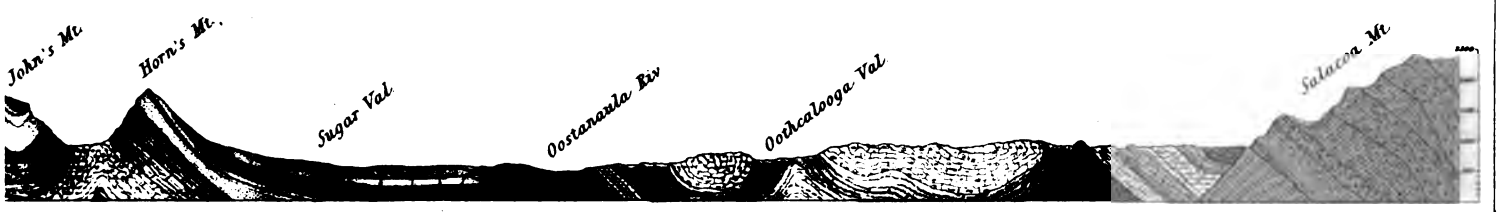
OF

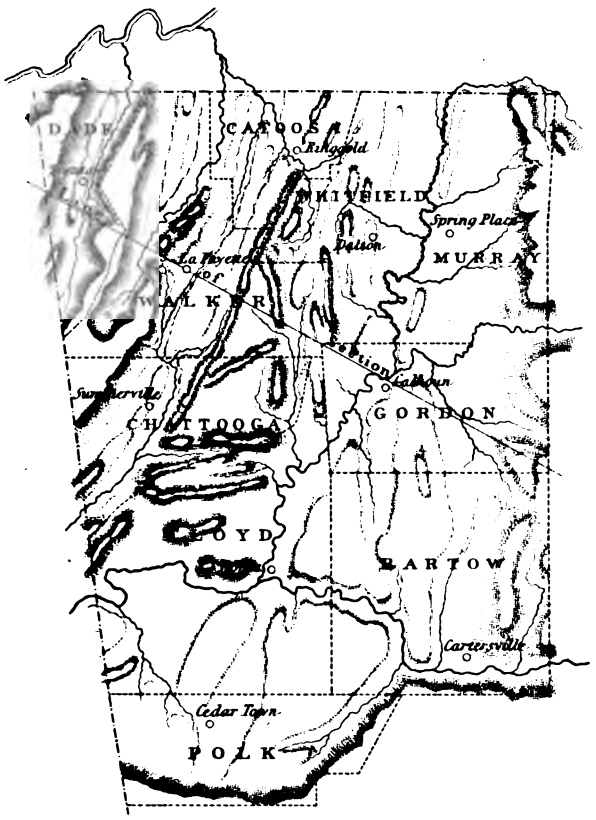
NORTH-WEST GEORGIA

BY

A.R. Mc CUTCHEN
SPECIAL AGENT.







- Limestone
- Cherty Limestone
- Siliceous Limestone
- Argillaceous Limestone
- Calcareous Shale
- Argillaceous Shale
- Argillite
- Hematite
- Siliceous Shales
- Sandstones & Conglomerates
- Chert
- Gneiss
- Mica Schist
- Chloritic Schist
- Debris (Up Q.)
- Coal

- Carboniferous
- Upper Subcarboniferous
- Lower Subcarboniferous
- Hamilton P
- Oriskany
- Clinton
- Medina
- Cincinnati
- Trenton
- Chazy
- Upper Quebec
- Lower Quebec
- Calciferous
- Potsdam
- Archæan

Julius Bien & Co. lith.

into clouds usually by cold winds approaching from the northwest. Thus the summer rains, and particularly the thunder-storms, come with clouds drifting in a direction almost the opposite of that of the winter rains. Severe wind-storms in the warm season are almost uniformly from the west.

GEOLOGY.—The geological formations embrace all of the *Palæozoic rocks* of the state, together with a part of the *metamorphic series*, bordering the former on the east and south.

The most highly crystalline of the *metamorphic rocks* in this part of the state are the hydromica and hornblendic schists and gneisses, abounding in quartz veins, that constitute the gold-bearing rocks of the southeastern part of the county of Bartow. These beds are more or less pyritous throughout, and are often deeply decomposed. The country is generally broken, though rarely mountainous, and the surface is commonly covered with loose quartz rocks. These gold-bearing beds are followed on the northwest by rocks that constitute the bulk of the Cohutta range of mountains, principally graphitic hydromica schists, conglomerates, and argillites, associated in the southeastern part of the range with heavy beds of chloritic schists and porphyritic gneisses, all dipping to the east, southeast, or south.

Palæozoic series.—The metamorphic series is followed on the northwest by the Palæozoic, from the primordial to the Coal Measures, inclusive. The aggregate thickness of the groups, estimating the primordial at 8,000 feet and taking the maximum thickness of each of the higher groups, amounts to about 20,000 feet. These strata are made up principally of sandstones, shales, and limestones. The siliceous rocks, including the sandstones, the siliceous shales, and the cherty beds associated with some of the limestones, are greatly in excess of the other materials, making up perhaps one-half of the entire thickness, while the argillaceous beds, or such as are composed largely of clay, are somewhat in excess of the limestones; but in the upper half of the series these materials are more nearly equal.

Silurian.—The Lower Silurian begins with a prevalence of sandstone and conglomerates, graduating upward into argillaceous shales and limestones, so that toward the top the limestones are greatly in excess of the shales and the sandstones are found only in the Chattoogata range at the close of the Trenton. The primordial and calciferous consist of sandstones and conglomerates, argillites, siliceous shales, and siliceous limestones. These are followed by rocks referred to the Quebec group: first by about 2,400 feet of shales, and then by 5,000 feet of cherty limestones, and this again by the comparatively pure limestones of the Chazy and Trenton periods, of from 600 to 1,000 feet in thickness.

The shales of the Lower Quebec are more or less calcareous throughout, and are generally of a light-green color at the depth of the constant water-level, but at the weathered surfaces these shales are banded with various shades of color, from white to red, blue, green, and brown to black, but most commonly some shade of brown. The strata generally dip at steep angles, and always abound in closed folds and contorted laminæ.

The limestone and chert of the Upper Quebec alternate in beds of irregular or rugged outline and of constantly varying thickness, the strata of one kind often including the other in great lenticular masses, but each retaining independently the traces of its own bedding. The limestone is generally dolomitic, though not always so in all its layers. The chert, which is of a dark blue color, weathers to a light gray, and more rarely to a dark gray, brown, or red. It breaks easily with an irregular fracture, and occurs on the surface in usually porous angular fragments of various sizes, rarely exceeding, or even equaling, one foot in diameter. Some of the upper beds of chert are of oolitic structure. This formation gives rise to ridges or knobby belts of country. The Chazy and Trenton groups consist of thin-bedded blue limestones, interstratified with calcareous shales, and contain some thin layers of flint or a cherty material that in some localities give a gravelly character to the soil. In Polk, Floyd, and Murray counties the character is similar, with a more uniform distribution of the cherty materials. In the Chattoogata range of the mountains east of Dick's ridge a marked change in the lithological character is observed. The rocks are found outcropping around these mountains as *red* and *dove-colored rotten limestone*, with rarely an admixture of the chert noticed as occurring elsewhere. This change may be seen in all its grades along a single outcrop at the western base of Taylor's ridge from Ringgold, where the blue limestone is found, to Cathy's Gap, in Chattooga county, in a distance of forty miles, the limestones becoming more and more argillaceous and ferruginous. The fossils that abound in the blue limestone at the same time disappear, until nearly all resemblance in character is lost. In Red Clay valley, and around Dalton, in Whitfield county, some heavy bedded fossiliferous red limestones or variegated marbles are associated with the rotten limestones.

The Upper Silurian in the Chattoogata range of mountains consists of the heavy-bedded Medina sandstone of 400 feet thickness, the Clinton sandstones and shales of 350 feet, and the Oriskany of from 1 foot to 15 feet. West of Taylor's ridge the Clinton only, with a thickness of from 200 to 400 feet, has been recognized. The Clinton group has three beds of fossiliferous red iron ore, varying in thickness from a few inches to 15 feet.

Devonian.—The Devonian rocks are, first, a black bituminous shale of from 10 to 50 feet thickness, followed by a blue shale that graduates above either into a hard siliceous limestone or into siliceous shales with characteristic geodes. The total thickness is about 200 feet.

Carboniferous.—The sub-Carboniferous is made up of two lithological groups: the lower a siliceous and cherty limestone of 200 feet, and the upper a heavy-bedded blue limestone of 400 feet thickness in some localities. The latter is generally fetid and bituminous in some of its layers. The shales, which are most abundant in the

middle portion of the series, are sandy and calcareous, and, with the loss of a portion of the lime in weathering, become porous and friable. The lower portion consists of siliceous limestones with cherty layers, and abounds in rounded flint nodules from a few inches to a foot or more in diameter. Porous cherty fragments, the result of a decomposition of these flints, are found abundantly in some of the soils. The decomposition sometimes discloses an oolitic structure not observable in the flint.

The *Coal Measures*, with a thickness of about 800 feet, consist of shales, sandstones, and conglomerates, with five beds of coal, the lowest of which is below the first conglomerate.

Dips.—As a rule, on the easterly side of the anticlinal folds the dip of the rocks is observed to be steeper than on the opposite side, so that the westerly dips approach nearer to the horizontal and the easterly dips nearer to the perpendicular, and are not infrequently overturned. In connection with this fact of the greater disturbance on the easterly side of the synclinals it is worthy to note that when the outcropping rocks give rise to a ridge or mountain that on the west is almost invariably the more prominent. Thus the Upper Silurian sandstones forming Taylor's ridge, on the west side of a synclinal trough, are on the east side exposed in a comparatively low ridge, known as Dick's ridge, and for some distance in Catoosa and Chattooga counties are swallowed up in a fault. In the next and most easterly occurrence of these sandstones, in the mountains of Whitfield, Gordon, and Floyd counties, the eastern side is faulted for their whole extent, bringing the overlying sub-Carboniferous, by a dislocation of 8,000 feet, in contact with some of the lowest groups of the Lower Silurian.

The increasing impurities in the limestones and the coarser constitution of the shales and sandstones are observed in following these from west to east. They are seen in the more argillaceous and ferruginous character of the Chazy limestones, and to a greater degree in the Trenton limestones (from which at the same time the fossils to a great extent disappear), and again in the Clinton, in which heavy-bedded sandstones and conglomerates take the place of calcareous shales and fine sandstones, with a great thickening of the beds.

These changes in the character of these sediments take place from Lookout to Chattoogata mountain, a distance of 25 miles. (*a*)

The table on page 23 gives the geological divisions that are represented in this region, and also the thickness of each group. The lithological features of each and of the same group vary somewhat in the eastern and western sections of the northwestern region, and it is of sufficient interest to represent this in the list by making Taylor's ridge (a prominent and sharp-topped mountain chain in the middle of the region) a dividing line and in the two columns showing the features of each group.

a There appear to be two horizons of unconformity in this part of the state. The first of these is strikingly indicated at Dug Down mountain between some of the Silurian groups and the metamorphic. The direction of this mountain is nearly east and west, and its rocks, consisting of gneiss and mica-schists, dip to the south or southeast, while the Quebec and Trenton groups approach the mountain on the north with folds trending north and south and with east and west dips. The Potsdam sandstones in Indian mountain, standing off to the northwest, show an approximate correspondence in the strike of its rocks with that of Dug Down mountain, and a like discordance with that of newer groups, which appear to cross its folds without marked evidence of disturbance. It is a remarkable fact, not corroborative, however, of the hypothesis of nonconformity, that the rocks of Dug Down mountain appear to show no flexures in correspondence with the folds in these newer rocks. This is most likely due to a great lateral dislocation here at the time of this disturbance.

The next horizon of unconformity is at the top of the Quebec group, evidenced in the relation of overlying groups to this in a number of localities, but more particularly in Dry valley, in Walker county. Here the Trenton and Clinton rocks, in an anticlinal valley or cove between Mission ridge and one of its westerly spurs, dip toward the east against the ridge, and also toward the west against this spur, passing around its terminal point, where, with the same angle of dip, it is covered by the sub-Carboniferous, also abutting against the ridge.

The rocks belonging to groups that afford arable lands are indicated in the table with an asterisk (*). The others in general enter into the structure of steep mountains and ridges.

Geological formations.	LITHOLOGICAL GROUPS.			
	West of Taylor's ridge.	Thickness.	East of Taylor's ridge.	Thickness.
		Feet.		*Feet.*
	* Thin-bedded sandstones and shales, with coal	400	Thin-bedded sandstones and shales	200
Carboniferous	Conglomerates and heavy-bedded sandstones	250	Conglomerates and heavy-bedded sandstones	150
	Shales, with bed of coal at top	200	* Shales	200
Sub-Carboniferous	* Heavy-bedded blue limestone	400	* Arenaceous shales and bituminous limestone	300
	* Siliceous limestone, with flint nodules	200	* Siliceous limestone, with flint layer and nodules	250
	Siliceous limestone, with geodes	100	* Calcareous shales, with geodes	75
Devonian	Black bituminous shale	80	* Black bituminous shale	40
	Blue shale, with phosphatic nodules	1	* Blue shale, with phosphatic nodules	5 to 15
Upper Silurian. Oriskany			* Siliceous skeleton [limestone?]	1
Upper Silurian. Clinton	Sandstone and arenaceous shales	350	Sandstone, with beds of iron ore	420
Upper Silurian. Medina	* Calcareous shales, with iron ore	250	Heavy-bedded sandstones	410
Lower Silurian. Cincinnati	* Calcareous shales	200	Argillaceous sandstones	200
Lower Silurian. Trenton	* Thin-bedded blue limestone and calcareous shales	600	* Red and dove-colored rotten limestone	1,000
Lower Silurian. Chazy	* Thin-bedded blue and gray limestone and calcareous shales	400		
Lower Silurian. Upper Quebec	* Limestone, with heavy beds of chert	5,000	* Limestone, with heavy beds of chert	5,000
Lower Silurian. Lower Quebec	* Argillaceous shales, with beds of oolitic limestone	2,500	* Argillaceous shales, with oolitic limestone	2,500
Lower Silurian. Calciferous and Potsdam			Glauconitic shales and sandstones	1,000
			Sandstones	(?)
			Argillites	(?)
Huronian			Conglomerates, slates, gneisses, mica-schists	(?)

The soils belonging to the different groups are in general well characterized, each affording a soil in many particulars peculiar to itself. For this reason it will be most convenient to consider separately the soils of certain groups of rocks (the geological groups to which they belong being added in parenthesis), arranged in accordance with general characteristics in common, or else with reference to accessory relations in the structure of valleys or other areas of arable lands.

The soils pertaining to a formation are often modified to some extent by the admixture of materials derived from adjoining groups in the wearing down of the country, or, as is rarely the case here, may be wholly composed of transported materials. This is true of some localities bordering on mountain slopes, but changes from this cause, to the extent of disguising the prominent soil characteristics inherent to the formations, are of rare occurrence on uplands in this country.

The following comprise the chief varieties as represented in northwest Georgia:

1. Gray sandy lands of the metamorphic border.
2. Flatwoods.
3. Red-clay lands.
4. Gray siliceous soils of the ridges.
5. Brown and red loams.
6. Yellow-clay lands.
7. Sandy table or mountain lands.
8. Alluvial lands.

Gray Sandy Lands of the Metamorphic (*Huronian*).

The metamorphic rocks to which these belong are confined mostly to rugged, mountainous areas on the eastern sides of Murray and Gordon and the eastern and southern sides of Bartow and Polk counties. The rocks named in the order of predominance are quartzites, conglomerates, slates, feldsitic gneisses, siliceous and graphitic hydromica schists, and chloritic schists.

These give rise in general to a gray sandy soil of moderate productiveness, the growth of which consists of red, black, post, and mountain oaks, hickory, chestnut, and short-leaf pine. In addition to this, in the higher portions of the Cohutta mountains, there are spruces, holly, and white pine. The lands are mostly in forests, owing to the broken character of the country.

"Flatwoods" (*Potsdam and Calciferous*).

These formations are made up of sandstones and hard siliceous and argillaceous shales, with siliceous limestones in certain localities. The siliceous shales are most abundant in the upper part of the series, and these are often glauconitic, while the sandstone occurs in both the lower and the upper beds. Owing to its somewhat varied lithological character, the topography is correspondingly diversified with mountains, hills, and nearly level "flatwoods", but the soils are nearly everywhere of one general character, at least with regard to sterility. The most extensive area of these lands is that of the flatwoods near the Oostenaula and the Coosa rivers, in Gordon, Floyd, and Polk counties, and a mountainous section south of the Coosa river, in Floyd and Polk counties, belonging to the same formation, and with which these flatwoods are continuous. It occurs again in a belt of hills in the southern part of Murray county, extending southward nearly across the county of Gordon. In the eastern part of Catoosa the glauconitic shales, with sandstones, are found in a narrow belt extending southward into Whitfield. It affords a thin soil of a gray or a light-brown color, with but little depth above the hard shales and sandstones, and the lands are generally regarded as unfit for cultivation. This land abounds in short-leaf pine, with post and red oaks as its principal forest growth.

Red-clay Lands (*Lower Quebec*).

These lands are underlaid by a series of shales and limestones of about 2,500 feet thickness. The region covers in Georgia about 400 square miles, occurring in belts of from half a mile to 2 or 3 miles in width, and is found in all of the counties under consideration except Dade.

The formation affords an argillaceous soil of an orange or light red color, and of great importance, nearly the entire area consisting of slightly rolling or nearly level lands, most of which have long been under cultivation. This soil contains more clay in general than most of the other good lands of the region, but is more or less calcareous, and contains a sufficient amount of sand or fine gravel, derived in part from bordering cherty ridges, to promote easy culture. The clay beneath the soil has varying depths of from 1 foot or 2 to 15 feet down to the shales, but rarely less than 4 or 5 feet. The generally rolling character of the land is sufficient for good drainage. The forest growth is red, white, and Spanish oaks, hickory, dogwood, chestnut, and pine; the principal agricultural products, corn, oats, wheat, clover and grasses, and cotton. Land of this character that has been kept in cultivation for thirty or more years, with little or nothing returned to the soil for its improvement, will now produce about 20 bushels of corn, 6 bushels of wheat, and 10 bushels of oats to the acre. These lands are, however, capable of a high degree of improvement, and where they have been properly kept up the yield is good. They rank as about third-rate uplands in relation to cotton culture, and with fertilizers will produce about 500 pounds of seed-cotton per acre. The lands, where hilly, are inclined to wash; but this can generally be prevented by horizontal plowing, though they are rarely so steep as to require this. The valleys in which these lands occur are supplied with numerous springs, running from the bases of cherty ridges that border them on one or both sides, and water is easily obtained in wells, that do not require curbing, at depths of from 20 to 40 feet.

Gray Siliceous Soil of the Ridges (*Upper Quebec*).

This region covers an area of 894 square miles, or about one-fourth of the entire extent of country. The formation gives rise to ridges or knobby belts of country of from 1 mile to 10 miles in width, with heights varying from 100 to 300 feet. Where these belts are broad, they often contain lands that are nearly level, or at least consist of low rolling hills.

The limestone beds in these ridges have been leached out, commonly to the depth of 100 feet or more; but the chert and less soluble impurities of the limestone layers cover the surface, and the formation is buried to this extent in its own *débris*. There are seven or eight belts of this character, some of which are continuous across this part of the state, known nearly everywhere by the common name of "the ridges".

The lands have a gravelly soil, varying in color from light to dark gray, with generally a porous gravelly subsoil; but in some places there is a good clay subsoil, with a gravelly soil of a dark brown or red color. These

lands are generally regarded as poor, and are for the most part in the original forests. The prices range from 50 cents to $3 per acre, according to situation, the highest values being given to such as adjoin the valley lands, without regard to their adaptation to culture. Recently attention has been attracted to these as among the most profitable lands for cotton. They are found to give a better *immediate return* for manures than the richer valley lands, and their present cheapness and comparatively easy culture, with their general healthfulness, give them additional importance. The timber is of good size, and consists of red, black, mountain, post, white, and Spanish oaks, chestnut, pine, hickory, dogwood, sourwood, and black gum. The oaks predominate, but chestnut and short-leaf pine are generally abundant. When the belts are broad and the lands nearly level, as in some portions of Bartow and Polk counties, the long-leaf pine is the prevailing growth. Hickory is common, especially where there is a somewhat compact subsoil, and the mountain oak is only found upon the high and steep portion of the ridges. Notwithstanding the hilly character of these lands, they are less liable to injury from washing than most of the uplands, the gravel and small stones with which the surface is covered, as well as the pervious character of the soil, protecting it. The cotton crop is less subject to injury from continued wet weather in the spring than on most other soils, and comes to maturity early, rarely failing to open well. The production with fertilizers is about 1,200 pounds of seed-cotton per acre. Corn does not do well on these lands after a few years' cultivation, except in very rainy seasons. With the use of fertilizers wheat might be made a profitable crop, as it is less subject to disaster and nearly always matures a better developed grain than on the richer valley lands; but without fertilizers it does not "tiller" or spread well, and the average yield is not so good. The lands are well suited for fruit culture, the trees being healthy and long-lived, and the tops and slopes of ridges here have an immunity from late spring frosts that often kill the fruit on lower lands.

There are no springs or constantly running streams in the central portions of these belts, and water is obtained with some uncertainty at depths of from 70 to 100 feet in wells that always require curbing. The drainage, except in wet weather, is confined to deep subterranean streams, which find outlets in the bold springs that occur in great numbers along the outskirts of bordering valleys.

The following analysis gives the composition of an average sample of these cherty ridge soils:

No. 506. *Gray cherty soil*, taken south of La Fayette, Walker county. Depth, 6 inches; timber growth, oak, hickory, poplar, chestnut, and pine.

Cherty ridge lands, Walker county.

	No. 506.	
Insoluble matter	81.470	88.926
Soluble silica	7.456	
Potash		0.422
Soda		0.277
Lime		0.197
Magnesia		0.878
Brown oxide of manganese		0.178
Peroxide of iron		1.989
Alumina		3.059
Phosphoric acid		0.411
Sulphuric acid		0.183
Water and organic matter		4.405
Total		100.926
Hygroscopic moisture		6.312
absorbed at		13 C.°

[This analysis shows that these lands are remarkably rich in potash and phosphoric acid, with a sufficiency of lime to insure their availability for the present at least. The generally prevailing idea that these ridge lands are of no value agriculturally is shown both by this result and by actual tests to be a mistaken one.—R. H. L.]

BROWN AND RED LOAMS.

These are formed from the limestones and calcareous shales of several geological formations, and, as they differ somewhat, they are described separately.

Lands of the Chazy and Trenton.—In Dade county, and in that portion of Catoosa, Walker, and most of Chattooga counties that lies west of Taylor's ridge, the lands are all highly calcareous, and are perhaps the richest uplands in the state. The timber is large, and consists principally of red, Spanish, and white oaks, hickory, poplar, sugar maple post oak, and cedar, with an admixture of most of the varieties indigenous to the country and common to the valley lands. The lands generally lie well, but are sometimes hilly and inclined to wash. Where the blue limestones are nearly horizontal, they are sometimes exposed, or else lie in close proximity to the surface. Such lands are usually

covered with a growth of cedar and red haw, and are known as cedar glades; but there are no very extensive areas of this kind. Where the limestones lie unexposed near the surface, this fact is usually indicated by a growth of post oaks.

The soil consists of two principal varieties, viz, a brown calcareous loam of the blue limestone areas and a red calcareous loam of the rotten limestone. The first varies in color from a light to dark brown and almost black, a dark or chocolate brown being the most characteristic color, with a subsoil of lighter shade, sometimes approaching to red. The soil of the rotten limestone belts is of a dark red color with a red subsoil. There is quite a striking difference in the appearance of these lands, though in the more essential characteristics of productiveness and in adaptation to various crops a comparison shows no important difference. In Polk, Floyd, and Murray counties the lands are red, but of a lighter color than that of the rotten limestones. Lands that have been in cultivation for thirty or more years will often produce from 30 to 50 bushels of corn to the acre. The soils seem to be considerably deteriorated for the wheat crop, but after the land has been rested in clover, and a crop of this turned under, from 10 to 20 bushels is not an unusual yield. Cotton has not been grown to much extent on these lands north of Floyd county, and in this county and Polk about 600 pounds of seed-cotton per acre is the usual yield.

Sub-Carboniferous brown-loam lands.—The rocks of this formation consist of limestones, arenaceous shales, and siliceous or cherty limestones. The lands, which are generally rolling, but sometimes nearly level where the valleys are broad, have a brown soil that is calcareous and siliceous, or sandy, with sufficient clay in the subsoil to give it a somewhat retentive character and yet admit of good drainage, even where the lands are nearly level. The areas of this character are in the valleys immediately around Sand, Lookout, and Pigeon mountains, in the broader valleys immediately east of Taylor's ridge, and again east of Horn's mountain, viz: West Armuchee valley, in Walker county; Sugar valley, in Gordon; Dirt Town valley, in Chattooga; and Texas valley, with a large portion of the country to the west of Coosa river, in Floyd county. These are decidedly the best cotton uplands in this part of the state, yielding often without fertilizers from 1,000 to 1,200 pounds of seed-cotton to the acre. They seem to be especially adapted to the cotton crop, but corn, wheat, and oats do well.

Analyses of the following soils of these red and mulatto lands have been made. (*a*)

A few samples of lands that have been in successful cultivation for very many years and without apparent diminution of productiveness have been added for comparison.

No. 505. *Mulatto soil* of West Armuchee valley, Walker county, taken 6 inches deep. Timber growth, oak, hickory, and pine.

No. 517. *Dark mulatto soil*, valley land near Cedar Town, Polk county, taken 8 inches deep. Growth, black, red, and post oaks, hickory, a few short-leaf pine and black gum, dogwood, walnut, and buckeye.

No. 502. *Mulatto soil*, cultivated, from near Cedar Town, Polk county, taken 8 inches deep. This soil has been under cultivation several years, and commercial fertilizers have been applied to some extent.

No. 503. *Subsoil* to the above, taken from 8 to 16 inches.

No. 66. *Upland mulatto soil* near Stilesboro', southwestern part of Bartow county, taken 3 inches deep. Growth, oak, pine, and hickory.

No. 67. *Subsoil* to the above, taken from 3 to 9 inches deep.

No. 68. *Upland mulatto soil*, cultivated, from near Stilesboro', Bartow county, taken 3 inches deep. This soil had been in cultivation about 50 years when taken in 1874. No fertilizers had been used. Its corresponding virgin soil, No. 66, was taken in the woods about 100 feet distant.

No. 69. *Subsoil* to the above, taken from 3 to 9 inches deep.

No. 21. *Red soil* of Pine Log valley, northeastern part of Bartow county, taken 10 inches deep. Timber growth, white oak, hickory, and pine.

No. 518. *Virgin mulatto soil* from the place of Colonel J. J. Fitten, near Adairsville, Bartow county, taken 8 inches deep. Timber growth, post and black oaks, pine, walnut, hickory, and persimmon. Lingula shales underlie this land, and small fragments occur in the soil.

No. 11. *Subsoil* to the above, taken a short distance from it. Depth taken, 8 to 12 inches.

No. 519. *Cultivated soil of the above*, taken 5 inches deep, to a hard, undisturbed clay subsoil. The field was cultivated by the Cherokee Chief Adair, 100 or more years ago, and has since been under cultivation without fertilizers.

No. 9. *Cultivated subsoil* of the above land, taken from 5 to 19 inches deep.

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a The samples with low numbers are of the state geological collection, and the analyses were made in 1875 for the Georgia department of agriculture; all others were collected and analyzed for the Census Office, and their numbers are merely used for convenience.—R. H. L.

Red and brown loams.

	Walker county.	Polk county.		
	West Armuchee valley.	Van's Valley red land, near Cedartown.		
	Mulatte soil.	Virgin soil.	Cultivated soil.	Cultivated subsoil.
	No. 505.	No. 517.	No. 502.	No. 503.
Insoluble matter	89.680	67.319	72.320	70.835
Soluble silica	1.713	91.393	5.207	72.526	4.230	76.550	12.180	83.015
Potash	0.178	0.334	0.725	0.320
Soda	0.065	0.068	0.165	0.067
Lime	0.047	0.286	0.290	0.205
Magnesia	0.031	0.392	0.255	0.317
Brown oxide of manganese	0.041	0.034	0.179	0.137
Peroxide of iron	1.750	6.234	6.290	5.800
Alumina	2.677	9.721	7.101	6.190
Phosphoric acid	0.188	0.042	0.261	0.360
Sulphuric acid	0.041	0.328	0.114	0.095
Water and organic matter	2.980	10.015	6.600	3.213
Total	99.391	99.975	98.530	99.719
Hygroscopic moisture	4.336	9.768	8.705	8.051
absorbed at	14 C.°	16 C.°	18 C.°	19 C.°
Humus		2.153		
Available inorganic		1.378		
Available phosphoric acid		0.036		
Available silica		0.701		

	Bartow county.								
	Raccoon Creek valley, near Stilesboro'.				Pine Log valley.	Cotecaloga valley, near Adairsville.			
	Virgin soil.	Cultivated soil (fifty years).	Virgin subsoil.	Cultivated subsoil.	Red soil.	Virgin soil.	Cultivated soil (one hundred years).	Virgin subsoil.	Cultivated subsoil (one hundred years).
	No. 66.	No. 68.	No. 67.	No. 69.	No. 21.	No. 518.	No. 519.	No. 11.	No. 9.
Insoluble matter	79.939	76.830	77.360	70.230	70.391	64.874		69.691	68.105
Soluble silica	3.271	83.210	6.850	83.680	5.041	82.401	9.970	80.200	4.400	74.791	10.988	75.862	79.711	11.088	80.779	10.674	78.779
Potash	0.209	0.207	0.155	0.337	0.225	1.150	0.503	0.925	0.706
Soda	0.001	0.009	0.020	Trace.	0.003	0.028	0.092	0.003	0.028
Lime	0.291	0.189	0.095	0.179	0.057	0.160	0.282	0.106	0.161
Magnesia	0.181	0.203	0.246	0.326	0.201	0.805	0.470	0.666	0.447
Brown oxide of manganese	0.436	0.234	0.255	0.142	0.389	0.150	0.178	0.278	0.373
Peroxide of iron	3.287	4.404	4.302	4.886	12.650	6.886	13.409	5.239	4.571
Alumina	5.176	7.097	7.896	3.373	5.750	7.720		8.823	10.784
Phosphoric acid	0.130	0.076	0.144	0.071	0.137	0.218	0.140	0.209	0.252
Sulphuric acid	0.063	0.045	0.063	0.037	0.002	0.016	0.035	0.063	0.037
Water and organic matter	7.019	4.496	4.591	4.862	5.256	6.681	5.637	3.512	4.595
Total	100.063	100.640	100.170	94.413	99.461	99.676	100.463	100.603	100.733
Hygroscopic moisture	7.740	6.680	8.560	8.020	9.790	8.410	6.440	9.440	7.840
absorbed at	21 C.°	17 C.°	18 C.°	17 C.°	16 C.°	17 C.°	17 C.°	17 C.°	20 C.°
Humus						1.852	1.774		
Available inorganic						0.606	1.313		
Available phosphoric acid						0.016	0.027		
Available potash						0.059	0.027		

[Of the above analyses, that of Walker county is perhaps not a fair sample of the rich and productive lands of West Armuchee valley, almost the entire area of which is under cultivation, leaving but few spots of virgin soil, usually inferior in quality. This seems to have been the case with this sample, for it is very deficient in lime, a thing unusual in the other lands of this group, and its potash percentage is also rather low.

The virgin soil of Polk county, sent in by Mr. Byrd as a fair sample of the lands of that region, while rich in potash, is very deficient in phosphoric acid. There is a fair percentage of lime, and its importance is evident in the fact that it renders even this small amount of phosphoric acid available, as is shown in the comparatively high productiveness (800 to 1,000 pounds of seed-cotton per acre). The humus percentage is also large. 293

In the cultivated soil there is an increase of both potash and phosphoric acid, but this is due to the commercial fertilizers that have been used in the cultivation of cotton.

The virgin lands of Raccoon creek, Bartow county, have a fair percentage of potash and phosphoric acid, with a sufficiency of lime to make them available. After long cultivation they seem not to have lost much of the potash, while the phosphoric acid and lime have been reduced about one-half.

The Pine Log valley soil has a deep red color, from the large amount of iron. It contains fair percentages of potash and phosphoric acid, but the lime is not in sufficient quantity to render these available for any great length of time.

The most interesting group of analyses is that of the soils of Oothcaloga valley, Bartow county, the specimens representing lands uncultivated and others of the same quality that have been in cultivation without fertilizers for probably 100 years. The specimens were carefully taken, and the analyses repeated on specimens taken about 200 yards distant from these. The analyses show a great reduction in the chief elements of plant-food after long tillage, and that even then the soil is rich in potash and has a fair percentage of phosphoric acid, with a sufficiency of lime to render it constantly available and the land productive. The extremely large percentage of potash in the soil is doubtless due to the fact that the lands are largely derived from the shales that abound in *lingula*, fragments of which are found interspersed through it. The methods of improvement in practice on this land have been rotation of crops and the turning under of green crops, especially clover.—R. H. L.]

Yellow Clay Soils (*Cincinnati and Clinton*).

The Cincinnati group and the lower portion of the Clinton group, in Dade county, and along the eastern side of Lookout mountain and around Pigeon mountain, in Walker county, consist of green calcareous shales that weather to a yellow or orange color. The rocks outcrop in the hills or on the slopes of the ridges around these mountains, and the lands to which they give rise are rich, and are very generally under cultivation. The soil is yellow or orange colored and rather argillaceous in character, though there is an admixture of fine sand and gravel that renders it easy of tillage. The steepness of slopes and character of soil predisposes the lands to wash, and horizontal hillside plowing is necessary to prevent washing. These lands are well adapted to corn and wheat.

Where these formations occur east of Lookout and Pigeon mountains they are represented by hard siliceous shales and sandstones, and in this character contribute largely to the materials of which the Chattoogata range of mountains is built.

Sandy Lands of the Mountain Summits (*Carboniferous*).

The portion of the Carboniferous series above the conglomerates, consisting of sandstones and sandy shales, gives rise to a gray or yellow sandy land, more or less gravelly and rocky. The soils of this character are, on table-lands, from 1,000 to 1,200 feet above the valleys. Sand mountain, in Dade county, Lookout mountain, in Dade, Walker, and Chattooga counties, and Little Sand mountain, in Chattooga county, afford the lands of this character, the total area of which is about 200 square miles. The topography varies from nearly level to rolling and hilly. The daily range of the thermometer here is about 50 per cent. less during the summer months than in the valleys, though the daily minimum temperature is usually but 2° or 3° less. Owing to this average low temperature, these lands are thought to be unfit for the growth of cotton, to which otherwise they would seem to be well suited. They are especially adapted to fruit culture and to a great variety of vegetables.

A variety of mineral springs is found on these table-lands, and these, together with the pleasant summer climate, give importance to this region as a health resort. The timber is of medium size, consisting of mountain, white, and red oaks, chestnut, pine, and hickory, with less undergrowth than is common to other woodlands in this part of the state, and with a good coat of grass covering the surface nearly everywhere.

Alluvial Lands.

In the mountains, where the streams are rapid, the alluvial lands have but little extent, but in the valleys the creek and river bottoms are comparatively broad. The bottom lands vary from about one-eighth of a mile on small streams to 1 mile or 2 miles on the larger ones, the greater part of their width being generally on the western side of the stream. The alluvial deposits of small streams vary more in character, those of the larger ones in general being most productive.

Alluvial lands with a large proportion of sand are the only ones on which cotton has been grown with success, the Coosa and Etowah rivers affording some of the best cotton lands in this part of the state.

The following analyses of soils and subsoils give an idea of the composition of the alluvial lands of the region, although the samples are from one county alone:

No. 70. *Dark bottom soil* of Raccoon creek, near Stilesboro', Bartow county, taken 10 inches deep. Timber growth, ash, poplar, gum, and elm.

No. 71. *Subsoil* to the above, taken from 10 to 15 inches deep.

No. 74. *Dark bottom soil* of Pumpkin-vine creek, near Stilesboro', Bartow county, taken 15 inches deep. Growth the same as above.

Alluvial lands, Bartow county.

	Raccoon creek.		Pumpkin-vine creek.
	Soil.	Subsoil.	Soil.
	No. 70.	No. 71.	No. 74.
Insoluble matter	84.192 } 88.830	82.050 } 88.920	83.110 } 87.000
Soluble silica	4.638 }	6.870 }	3.890 }
Potash	0.205	0.212	0.160
Soda	0.001	0.002	0.021
Lime	0.211	0.126	0.264
Magnesia	0.205	0.255	0.509
Brown oxide of manganese	0.127	0.058	0.067
Peroxide of iron	2.250	3.568	3.146
Alumina	3.631	3.800	3.896
Phosphoric acid	0.099	0.147	0.242
Sulphuric acid	0.028	0.013	0.055
Water and organic matter	3.737	2.561	4.212
Total	99.324	99.662	99.572
Hygroscopic moisture	4.550	4.550	4.170
absorbed at	18 C.°	17 C.°	18 C.°

[From the above it appears that these lands are not as rich in the elements of plant-food as some of the red and mulatto soils of the valleys. Their sandy character well adapts them to the cultivation of cotton, but this is partly counteracted by their low situation. There is nothing in these analyses to indicate great durability in the lands, though the percentages of potash and phosphoric acid are sufficient in the presence of the lime to insure fair productiveness for some time.—R. H. L.]

THE METAMORPHIC REGION.

The rocks and soils characterizing the metamorphic region cover the whole north half of the state except northwestern Georgia. Its southern limit follows an irregular line, passing through the cities of Augusta, Milledgeville, Macon, and Columbus. These cities, situated respectively on the Savannah, Oconee, Ocmulgee, and Chattahoochee rivers, mark the heads of navigation, shoals and falls in the streams at these points being formed by the outcropping gneisses and other metamorphic rocks. The dividing line between this and the northwestern region would pass from Alabama slightly northeastward through the southern part of Polk county to the northern part of Paulding, and into the southeastern corner of Bartow; thence north, through the eastern parts of Bartow, Gordon, and Murray counties, into the state of Tennessee. There are, in all, fifty-six entire and portions of seventeen counties included in the metamorphic region, and the area is approximately 19,090 square miles. The entire surface of the country is or has been heavily timbered, with the exception of the bald areas, without either vegetation or soil, where granite is exposed. The timber growth common to the entire region comprises red, white, post, and black-jack oaks, chestnut, hickory, short-leaf pine, dogwood, black gum, and walnut on the uplands, and poplar, ash, elm, sycamore, birch, and sweet gum on the lowlands. It has been estimated that of the entire metamorphic region about 46 per cent. has been cleared for cultivation, leaving 54 per cent. of the original growth still standing. The northern portion of the region differs so widely in its features from the rest of the metamorphic counties that it will be described under the subdivision of "The Blue Ridge region". Its rocks and soils are, however, similar to those of the other counties, and a separate color is not necessary on the map.

The Blue Ridge.—The Blue Ridge is the southwest termination of the Alleghany mountains of Virginia and North Carolina. In these states the mountains and valleys are spread over a wide territory, which also extends southward into South Carolina, forming what is known as the Piedmont region.

Soon after entering Georgia, and especially after leaving Rabun county, it is but little else than a long and high ridge, so narrow and with sides so steep that it forms a most convenient boundary-line southwestward between the counties north and south of it. From the main ridge a number of others form, as it were, offshoots, known by different names.

In Pickens county the Blue Ridge terminates with several isolated and short mountain ridges, which have the same trend as the main ridge. Another line of high mountain ridges leaves the terminus of the Blue Ridge proper, and, with a northwesterly trend, passes through Gilmer and Fannin counties into Tennessee.

The general elevation of the valley lands at the foot of the ridges is from 1,600 to 1,800 feet, and from them the mountains rise abruptly from 2,000 to 3,000 feet, their sides and sharp summits being covered with a somewhat dense timber growth. The general height of the Blue Ridge varies with the many high points and low gaps that are found throughout its length. Many of the highest points have been triangulation stations of the United States coast survey, and their altitudes are thus given:

	Feet.
Enota, in Towns county	4,796
Rabun Bald, in Rabun county	4,718
Blood, in Union county	4,468
Tray, in Habersham county	4,435
Cohutta, in Fannin county	4,155
Yonah, in White county	3,168
Grassy, in Pickens county	3,090
Walkers, in Lumpkin county	2,614
Chattahoochee ridge, at Mount Airy, Habersham county	1,600

From these high points magnificent views may be obtained on a clear day. The mountain chains of this and the adjoining states appear in the distance as faint blue, irregular lines, while in the intermediate space are the well-timbered and isolated mountains, small hills and ridges rising in rounded undulations, interspersed with streams and patches of farming lands, small, few and far between, with here and there isolated houses.

The counties included in the Blue Ridge region are Rabun, Towns, Union, Fannin, Gilmer, Pickens, Dawson, Lumpkin, White, and Habersham, making a little over 3,000 square miles. About 3¾ per cent. of their aggregate area is estimated to be too hilly and broken for tillage.

MIDDLE AND SOUTHERN METAMORPHIC, OR MIDDLE GEORGIA.—Southward from the Blue Ridge counties the elevation of the country becomes less and the surface less mountainous, though still hilly, to the Chattahoochee river. The mountains now are mere isolated ridges or points of from 500 to 700 feet above the general level of the country. Their sides are steep and their summits sharp, and they are all timbered. Sawnee mountain, in Forsyth county, is 1,968 feet high, and Kennesaw mountain, in Cobb county, is 1,809 feet high. Only 7 per cent. of the lands of the eleven counties embraced in this region is too broken for successful tillage, and, together with the Blue Ridge region, it forms the great gold-bearing belt of the state from North Carolina to Alabama. Other minerals also occur, such as corundum, asbestus, and copper.

On the south side of the Chattahoochee river, and within a few miles of it, the ridge, which in Habersham county is high and prominent, falls in elevation southwestward to Atlanta, and to that point is the water-divide of the Atlantic and Gulf tributaries; its summit is very nearly marked by the course of the Air-line railroad.

Atlanta, situated on the point where the water-divide turns to the southeast, has an elevation of 1,050 feet above the sea and 288 feet above the Chattahoochee river. The height of the ridge above the surrounding country is scarcely perceptible, as it rises gradually northeastward to Habersham county, where the ascent from the south is very abrupt for several hundred feet.

From the river southward to the sand-hills, a distance of about 70 miles, there is a gradual fall of 400 feet, the elevation being about 600 feet along the lower limit of the metamorphic, except that section between the Ocmulgee and Ogeechee rivers, which has an altitude of only 300 or 400 feet. About 1½ per cent. of the area of the twenty-two counties in this region is too hilly and broken for tillage.

There are a number of ridges and isolated mountains in this section. Graves' mountain, in Lincoln county, is the only one of prominence on the east, its altitude being 300 feet above the surrounding country. It is composed of a very friable sandstone, having crystals of lazulite, associated with rutile and manganese ore. Other mountains in the middle of the region are Alcova mountain, in Walton county, 1,088 feet high, and Stone mountain, in De Kalb county, 1,686 feet. Still farther southwest Pine and Oak ridges, lying parallel in Harris and Talbot counties, are only about 300 feet above the general level of the country, but, because of their isolation, are visible from a great distance. Their summits are sharp, except where deflections occur in the trend of the mountain, at which points the surface is broad and level.

MINERAL CONSTITUENTS OF THE ROCKS.—The minerals that enter into the composition of the rocks are present in greatly varying proportions in the different varieties, and may be briefly mentioned. Quartz, or silica, is more generally diffused throughout the rocks of the state than any other mineral, and it determines largely the physical or mechanical character of the soil. The mineral feldspar contains, besides silica and alumina, from 14 to 16 per cent. of either potash, soda, or lime, which give to it an agricultural importance. By decomposition these are set free as soil ingredients, the silica and alumina going to form the white clays known as kaolin, immense beds of which are formed along the southern line of the metamorphic region.

Mica occurs still more abundantly than feldspar, being very generally associated with it in the granite and gray gneisses, and forming besides great beds of mica-schists. The mineral is popularly known as "isinglass", from its strong outward resemblance to that article. In but few localities does it occur in large, clear sheets suitable for use. In the various rocks it is found in sizes down to extremely small particles, and usually in thin flakes only. It is not easily decomposed, and, being readily borne by currents, is found in the sands and clays of the region far south of the metamorphic, recognizable by the bright shining particles.

There are several varieties of mica recognized in Georgia, but only two are of any importance. The clear, bright, common "isinglass" variety is known as muscovite, and contains 4 per cent. of iron, 2 of magnesia, and 9 of potash, with silica and alumina. The other variety is a black "biotite", very common in the metamorphic region south of the Chattahoochee river, and especially in the granites and gneisses of the central portion of the region, or the counties of Henry, Butts, Pike, Jasper, etc. Its composition is 8 per cent. of iron, 22 of manganese, 10 of potash, the remainder being silica and alumina. Hornblende is largely present in the rocks, and together with its associated and closely-related minerals, pyroxine and epidote, it furnishes the soils of the metamorphic region with its highly important element of plant-food, lime, of which it contains about 12 per cent. In addition to lime, it contains 18 per cent. of magnesia and 10 of iron. The result of decomposition is a red clayey soil more or less calcareous, and dependent upon other minerals for potash and phosphoric acid.

CHIEF ROCKS.—*Granites.*—The granite is a gray and massive rock, resembling the gneisses except in structure, which has often associated with it narrow outcrops of hornblendic material and occasional trap bowlders. Tourmaline crystals usually mark the occurrence of granite in Georgia.

Gneisses.—These are laminated in structure, and are of two varieties: feldspathic, a gray rock having the composition of the granites, and hornblendic, in which the mineral hornblende replaces the mica and sometimes the feldspar. The gray gneisses vary as much in the proportions of their ingredients as do the granites, and very often pass into the latter so gradually as to be scarcely distinguishable from it. They often form excellent building material by their firmness, durability, and the fineness of their ingredients, while on the other hand the rock is sometimes coarsely crystalline, the feldspar presenting large bright faces on the surface. These rocks cover large areas in Georgia, and from them is largely derived the gray sandy lands. They are associated frequently with narrow strata of other rocks of the series.

The *hornblendic gneisses* do not occur as generally as the other variety. Hornblende is the most prominent ingredient in the rock, giving to it a black or speckled appearance, according to its percentage. The rock grades into a schist and other varieties, but all resist decomposition to a greater degree than the feldspathic gneisses. The red clayey lands derived from it are found all over the region, either in wide or narrow belts, isolated areas, or thin strata between other formations.

Mica-schist.—This is a loose or very friable material in the metamorphic series, having the appearance of a mass of mica scales cemented together with clays or silica, but stratified and penetrated with quartz veins of every thickness, from the fraction of an inch to a foot, and even more, and from which are derived the great quantities of quartz-rock and gravel that are found over the region. These schists are often gold-bearing, especially north of the Chattahoochee river.

Itacolumite.—This sandstone occurs in belts in various parts of the metamorphic region, and in Hall county and the northern part of Gwinnett forms the chief feature of Hog mountain. Along the south side of the Chattahoochee it is highly talcose, with dendritic markings, and in a number of counties it is very flexible in its nature.

Magnesian rocks.—These embrace the "soapstones", or talc, etc., which contain from 25 to 44 per cent. of magnesia and occupy small areas and narrow belts or outcrops in various portions of the state. They contribute to the soils but very little that is valuable.

All of the rocks of the metamorphic contain more or less of other minerals, which, by decomposition, add other elements to the lands, but they are not in sufficient quantities to make a description important.

Decomposition of rocks.—The average depth of decomposition which the rocks of the metamorphic have undergone is from 30 to 40 feet, the resulting materials below the immediate surface still retaining the position and dip of their original strata. Sometimes this undisturbed condition extends to the surface, but there is usually a deposit of clay, sand, and gravel over the upturned strata having a thickness of but a few inches on the hills and of several feet in the valleys. Very often it happens that thin beds of quartz, grit, and gravel form the first deposit on these strata and are overlaid by the subsoil and sandy soil. Portions of rocks that have resisted decomposition are often found in their original place in the decomposed material and at various depths from the surface. This decomposition seems to have been more complete and extensive in the southern than in the northern half of the region, which perhaps is due to the greater proportion of siliceous rocks on the north, with an apparent corresponding preponderance of micaceous and feldspathic rocks on the south.

AGRICULTURAL FEATURES.—As a consequence of the ever changing character of rocks forming them, and in the absence of the great transporting agencies that have so mixed and made uniform the soils of the various southern belts, there is less uniformity in the character of the soils of the metamorphic than in those of the southern part of the state. The lands may generally be arranged in four groups, viz: *gray sandy and gravelly soils*, *red clays*, including mulatto or chocolate-colored sands and clays, *granite lands*, and *flatwoods*.

The red lands pass through the various shades of color, from the deep, almost blackish red, to the light mulatto or chocolate, and almost invariably have a deep red clay subsoil.

The gray and sandy lands are somewhat dark on the surface from decayed vegetation, and are often gravelly and rocky. The subsoil, or underclay, is for the most part of a red or yellow color, and is more or less sandy. Its near approach to the surface, and its exposure on hillsides and in small areas in nearly all of the cultivated fields,

gives a variety to the soils in almost every acre in the gray lands of the metamorphic region. These lands, while very much intermixed, are respectively found to occupy large areas and belts, in which one variety or color is most prominent and almost exclusively prevalent.

These belts are extremely irregular in their northeast and southwest course through the state, following in this regard the general direction of the rocks of which they are the decomposed representatives.

GRAY SANDY LANDS.

The disintegration of the quartz, feldspar, and mica of the gray gneiss rocks produces a loose, sandy, gray soil, more or less clayey, and covered or mixed with gravel and loose quartz-rock. The subsoil is usually a yellowish clay.

The mica-schists, which also are found in large areas, are more or less garnetiferous, and are penetrated by quartz seams and veins of every size. By the disintegration of these schists a gray sandy, gravelly land is produced unless there is present much iron or biotite mica, as in the southern part of the region. By the subsequent denudation of the surface of the country the quartz fragments are either left on the surface or transported as gravel and sand to the low country. They are often accompanied by narrow decomposed strata of other rocks of the series, but no material change is perceptible in the lands.

The quartz veins alluded to often contain gold-bearing pyrites, which, by decomposition along with the other rocks, leave in the quartz black or reddish cavities, in which the gold either remains in small particles or becomes intermixed with the sands and clays, to be washed down the streams when opportunity offers. This feature of the quartz veins is especially noticeable in the country north of the Chattahoochee river, where many stamp-mills are in successful operation, and where the farmer, after "laying by" his crops, spends his extra hours, until the time of gathering, in panning out gold dust from the sands in the "pockets" of the creeks and ravines.

The gray sandy lands of the northeastern part of Habersham county and adjoining portions of Rabun are from the sandstone which forms Tallulah mountain, and which underlies a large portion of this region. Many other rocks of the metamorphic are highly siliceous.

Area.—The area covered by these gray lands can only be approximately outlined because of a want of minute examinations of the entire section, and because of the existence of small areas of red lands all over that country which is designated as gray land. The country north of the Chattahoochee river across to the Alabama line is, for the most part, covered by soils of this gray character. Red lands are often formed from the mica-schists, there being but two or three narrow red belts, as far as at present known, to break the continuity of the gray lands from the river to the Blue Ridge chain on the east and the northwest Georgia region on the west. Answers from correspondents give as the *entire* area of gray lands in the section named over 60 per cent. of the surface of the country. A number of the counties have little other than this soil.

South from the Chattahoochee river, on the eastern side of the state, after passing a broad red belt, we find the gray sandy lands, from gneisses, extending southward to Columbia county with but few intermissions. The gray granitic soils of Elbert and Lincoln counties are included in this area. These lands are a continuation of the broad and extensive gneissic soils of South Carolina, and are found westward until interrupted by the southerly trend of the red lands in Jackson, Clarke, and Oconee counties, their rocks also taking the same direction. Still farther westward, to the large granitic region, the gray lands, derived from gneisses and mica-schists, follow in their course the general south and southwesterly bend peculiar to this section of the metamorphic.

On the western side of the state the rocks have resumed their regular southwest and northeast trends, and from the northwest region at Dug Down mountain, in Haralson county, to the pine hills in Muscogee county the gray sandy lands are but slightly interrupted, except in Troup county and at the county-line of Haralson and Carroll counties, where red lands again appear.

Topography and character of the land.—The surface of country covered by gray lands is always more or less rolling and hilly, but has broad level areas either on the ridges or in the valleys. The slopes of the ridges are so gradual as not to interfere with their successful cultivation, excepting, of course, in the more mountainous districts. Their light sandy nature makes them very liable, when opened up to cultivation, to wash into gullies and flood the lowlands with sands, but the methods of hillside ditching and horizontalizing practiced are successful in preventing such damage. There is comparatively little of the gray lands too broken for cultivation outside of the Blue Ridge mountain region. The growth is generally short-leaf pine, post, Spanish (red), and white oaks, hickory, dogwood, and persimmon, with some ash, black and sweet gums, poplar, walnut, and cherry on the lowlands. Pine has not as large a growth as on granite lands, and only the short-leaf variety is found.

The soils are coarse, gray, and sandy, frequently colored dark for an inch or two with decayed vegetation, are more or less gravelly, from 3 to 12 inches deep, and have a yellow, clayey subsoil. From the intermixture of the soil and subsoil by cultivation a yellow mulatto soil is obtained. Loose quartz-rocks or stones are often so abundant on the surface as to require removing before the ground can be broken up.

Though these lands are said to produce late crops of cotton, they are preferred to the red clays, as being more productive, and because they enable the stalks to stand the drought better. They are also easy to till, and a larger

are found chiefly in the central part of the region, usually not more than 100 feet wide, and some but a few feet. The rock slowly decomposes on the surface into a deep yellow ocherous and silty material. So thick are they piled up on each other, and so varied are the sizes, that fences are often built of them. The area occupied by the dike is untillable because of the rocks, and on either side the decomposed material extends but a short distance.

THE DIFFERENT RED BELTS.—It has already been stated that the country north of the Chattahoochee river, including the Blue Ridge, has almost entirely gray sandy soils, excepting, of course, the many patches of red land that always accompanies them. A narrow belt of mulatto land reaches from Rabun county southward into Lumpkin county, and thence probably turns northward into Forsyth and Milton, but becomes very much intermixed with gray soils in those counties.

Along the foot of the Blue Ridge some red areas also occur in Towns and Union counties, where there is much hornblendic rock.

Another red belt from the northeastern part of Cherokee county passes southward (south of Canton) into Cobb, Paulding, and north Carroll counties. This belt is formed from hornblendic gneisses exclusively, and is deep red and clayey, rather sandy on the surface, and covered with loose rocks. Kennesaw and Lost mountains, in Cobb county, situated on the upper limit of this belt, are composed entirely of hornblendic gneisses, while Sweat and Black-Jack mountains, on the southern edge, are composed of quartz. These lands are considered best for grain, though cotton is largely planted on them, especially in the more sandy portions, and because of early frosts fertilizers are used to hasten maturity.

From the Chattahoochee river southward to the pine hills the country embraces the largest areas of red lands. Chattahoochee ridge of Habersham county is composed mainly of hornblendic rocks, and on the south, lying parallel with the river, is a narrow belt of red land extending into Fulton county to the granite section, at East Point, with an apparent continuation on the west into Coweta and Troup counties, and terminating a little west of La Grange; thence, after a narrow break, a wide area extends southwesterly into Alabama. Some outcrops of soapstone, serpentine, and corundum are found accompanying this belt.

On the east and south of the central granite region the red lands largely predominate, covering large areas and occurring in wide belts. In the gourd-shaped areas lying immediately to the east and south of the granite region the red lands are formed mostly from biotite gneisses or granites, small areas of gray soils being found associated or mixed in with them.

The apparent termination of one of these areas is found in the valley land between Pine and Oak mountains, in the northern part of Talbot and Harris counties. In this valley there is a narrow ridge of quartz lying along near the center, while on either side are hornblendic granites and deep red-clay lands. The ridges or mountains on both sides of the valley are formed of sandstones many feet thick. Another extensive belt of red land occurs north of Milledgeville, Baldwin county, and along the line of the southern granite region westward and northeast into Hancock county.

The largest of these belts is that which enters the county of Franklin from South Carolina with a southwest trend, and, turning southward through Clarke, Morgan, and other counties, again turns southwest to the sand-hills. The belt at first is very wide, covering nearly the whole of Franklin, and its lands are formed principally from hornblendic rocks; but southward it narrows, and biotite gneisses are occasionally found associated with the strata.

In the southeastern part of the region there are but few red areas, and these are mostly from hornblendic rocks, and lie on the outskirts of the granite region.

Topography and character of the soils.—The surface of the country occupied by these red lands is rolling or undulating and often somewhat hilly, there being but few very level areas, and then not in very large tracts. Very little is too broken for cultivation.

The growth is red or Spanish, white, and post oaks, hickory, chestnut, dogwood, and some short-leaf pine, with poplar, ash, walnut, cherry, and buckeye in the lowlands of some of the counties. The proportion of hickory is much larger, and that of pine much less, than on gray sandy land. Black-jack is occasionally interspersed with these. The red lands are usually sandy for a depth of several inches, and hence are rather easily cultivated, especially in dry weather. Decayed vegetation frequently gives to them a dark or "black" surface, but the subsoils and underclays are very red. The latter, being "in place" and derived from the disintegrated and decomposed rocks, are variegated, showing different colored strata. On these red lands cotton grows very well if the soil is loose and sandy. The cotton yield in the northern portion of the largest belt is given as from 300 to 500 pounds per acre on fresh lands and from 200 to 300 pounds after a number of years' cultivation. In Morgan county the yield is given at about 800 pounds per acre on fresh and 450 pounds on old lands, while in Monroe 1,000 pounds is reported on fresh and from 100 to 400 pounds after twenty-five years' cultivation.

The lands are in general difficult to till in wet weather, being sticky, and in dry seasons are very hard and compact, yielding about 800 pounds of seed-cotton per acre when fresh. In some of the counties as much as 1,000 pounds yield is reported, while in others only 600 pounds. Those east of Flint river and south of the 34th parallel of latitude report from 800 to 1,000 pounds per acre, while those west of Flint river report from 600 to 800 and north of the 34th parallel from 300 to 600 pounds. After ten years' cultivation (unmanured) the first group reports a

yield of from 400 to 700 pounds; the second and third group from 250 to 400 pounds. The maximum yield per acre reported from fresh lands is from 1,200 to 1,500 pounds, in Putman county; the minimum, from 250 to 500 pounds, in Cobb county; but fertilizers give an average of about 685 pounds per acre for both new and old land.

Except, perhaps, in the southern counties, these red-clay lands are considered best for small grain (especially oats), as they are cold and their cotton crops are late in maturing. A large proportion, probably one-third, of these lands under cultivation is devoted to cotton.

The following analyses are given of specimens of red soils from various counties:

Nos. 149, 150. *Red-clay soil* and *subsoil* near Elberton, Elbert county, taken respectively to depths of 5 and 12 inches. The growth is red, white, and post oaks, dogwood, hickory, chestnut, and pine.

Nos. 390, 391. *Red soil* and *subsoil*, 9 miles east of La Grange, Troup county, taken to the depth of 6 inches.

Nos. 254, 255. *Mulatto soil* and *red subsoil* from the northeast part of Monroe county, taken to the depth of 6 inches.

No. 203. *Deep-red soil*, north of Marietta, Cobb county, taken 8 inches, and has a growth of post and red oak and hickory.

No. 516. *Reddish soil* from near Milledgeville, Baldwin county, taken 6 inches deep.

Nos. 514, 515. *Red soil* and *subsoil*, taken from Dr. T. P. Janes' place, near Penfield, Greene county.

Red lands of the metamorphic.

	Elbert county.		Troup county.		Monroe county.		Cobb county.	Baldwin county.	Greene county.	
	near Elberton.		Nine miles east of La Grange.		Northeast from Forsyth.		North of Marietta.	Milledgeville.	near Penfield.	
	Soil.	Subsoil.	Soil.	Subsoil.	Soil.	Subsoil.	Soil.	Soil.	Soil.	Subsoil.
	No. 149.	No. 150.	No. 390.	No. 391.	No. 254.	No. 255.	No. 203.	No. 516.	No. 514.	No. 515.
Insoluble matter	73.690	81.820	77.688	77.005	81.924	71.582	60.370	82.402	75.803	73.805
Soluble silica	3.370 } 77.060	4.010 } 85.836	5.747 } 83.435	7.937 } 84.942	5.453 } 87.377	9.021 } 80.603	2.000 } 62.370	3.340 } 85.742	5.001 } 80.804	7.155 } 80.960
Potash	0.176	0.131	0.147	0.138	0.129	0.154	0.186	0.134	0.151	0.128
Soda	0.004	0.080	0.049	0.015	0.042	0.093	0.119	0.034	0.035	0.014
Lime	0.090	0.081	0.059	0.091	0.057	0.033	0.070	0.132	0.162	0.077
Magnesia	0.112	0.037	0.127	0.151	0.125	0.149	0.065	0.353	0.146	0.180
Brown oxide of manganese	0.146	0.072	0.029	0.064	0.029	0.005	0.196	0.030	0.020	0.150
Peroxide of iron	5.989	5.177	4.812	5.213	4.160	9.212	9.705	3.803	5.877	4.343
Alumina	7.305	4.383	5.670	6.713	3.566	3.810	18.066	4.554	5.779	9.572
Phosphoric acid	0.071	0.051	0.131	0.100	0.137	0.164	0.204	0.030	0.096	0.055
Sulphuric acid	0.055	0.069	0.115	0.071	0.085	0.368	0.285	0.029	0.015	0.008
Water and organic matter	8.891	3.506	5.360	3.776	4.398	5.311	8.953	5.382	6.777	4.832
Total	99.899	99.417	99.934	101.274	100.105	99.902	100.219	100.232	99.862	100.319
Hygroscopic moisture	15.980	3.788	3.533	3.841	3.498	4.709	8.479	4.890	6.600	5.180
absorbed at	22 C.°	20 C.°	18 C.°	19 C.°	13 C.°	16 C.°	13 C.°	11 C.°	16 C.°	16 C.°

A comparison of the results shows that the red-clay soil of Cobb county contains an unusually large percentage of phosphoric acid, and is a characteristic hornblendic soil, though containing little lime. The report of productions from the county places that of these fresh lands as between 250 and 500 pounds of seed-cotton per acre, and after three years as only from 150 to 300 pounds. The very large amount of clay—nearly 20 per cent.—gives to the land a cold, stiff character, unsuitable for cotton.

The Monroe county soil and subsoil, which shows much less amounts of these elements, is reported to yield from 800 to 1,000 pounds of seed-cotton when fresh and 500 to 700 after ten years' cultivation. The land is much more loose and sandy and has a little more lime than that of Cobb county, while the subsoil is more clayey. The Monroe land is derived chiefly from biotite gneisses.

GRANITIC LANDS.

Large and small areas of gray sandy soils having outcropping and underlying granite rocks are found in many counties of the metamorphic region, but chiefly in its southern half, and cover about 2,600 square miles. The rocks often graduate into the gray gneisses in such a manner that the line of separation cannot easily be determined.

Topography and soils.—The surface of the country is generally rolling and broken, with sharply defined and rounded hills in localities which have the granite bowlders or rounded masses, and broad level areas when only the flat rock underlies the land. A little hornblende occasionally accompanies the granite, and black tourmaline crystals are also often found in the quartz-rock near its outcrop.

The almost universal timber growth on all these lands is pine (either long or short leaf), with oak, chestnut, hickory, and some black-jack.

The soil is often a coarse gray or gravelly sand from 3 to 6 inches deep, with a subsoil of yellow or red clay more or less sandy, or sometimes a whitish impervious clay, the result of feldspar decomposition. The soils are reported by some as cold, but are easily tilled and well adapted to cotton culture. About 2 per cent. of the entire granite lands of the state are reported to be untillable either from their broken character or because of the exposure of the granite or its near approach to the surface. In Columbia county one of these exposures is said to cover 125 acres, there being nothing but flat and bare rock, having a low scrub growth only in its seams and crevices.

The yield per acre on these lands is about 800 pounds of seed-cotton when fresh and unmanured, equal to 270 pounds of lint. Cultivation rapidly reduces this product to 350 pounds of seed-cotton. Cotton is planted only on the uplands, it being liable to rust on the lowlands.

Localities.—The largest area of granitic lands lies south of Atlanta, covering all of Clayton, Henry, Fayette, and Rockdale counties, and portions of Fulton, Campbell, Coweta, Spalding, Butts, Newton, De Kalb, Walton, Gwinnett, and Jackson, while an offshoot follows the river in a southwest course. It covers in all about 1,660 square miles, and has a general altitude of from 900 to 1,000 feet above the sea. The surface of the country in De Kalb and Fulton and some of the counties southward is very broken, with granitic hills and outcrops of large rounded masses or weathered bowlders. Stone mountain, 1,686 feet high, or 800 feet above the surrounding country, and Little Stone mountain (near Lithonia, in De Kalb county) are the most prominent of these hills. The base of the former covers 2,000 acres. Southeastward, and also northeast in Gwinnett and Jackson counties, the country is very much more level but still rolling or undulating, the granite existing chiefly in its "flat rock" character or largely decomposed. Large areas of land lie beautifully for farming purposes in many parts of the region.

The rocks of the region are generally coarse, with large crystals of feldspar. There are quarries, however, of fine building material. The mica is chiefly the clear variety on the north and west, but southward it changes to black. Hornblendic gneiss appears in small patches, with accompanying red soils in many places southward. The coarse granites give to the soil a loose gravelly and sandy character, with over 90 per cent. of sand and other insoluble matter.

As shown by the analyses of a Clayton county soil, the lands also contain a fair percentage of potash and phosphoric acid, though lacking in lime. These soils, from 3 to 6 inches deep, have a yellow or red clayey subsoil, and are said to produce, when fresh, about 12 bushels of corn or 800 pounds of seed-cotton, equal to 267 pounds of lint, per acre. This yield, however, rapidly diminishes, and the use of fertilizers is necessary to keep it above 350 pounds after a few years' cultivation. Even with the aid of fertilizers, which are almost universally in use, the average yield per acre is only about 500 pounds of seed-cotton.

The granite lands of other counties in the metamorphic region differ but little from those just mentioned. The surface presents the same characteristics, with gray sandy and gravelly soils and red and yellow clay subsoils.

In Lexington, Oglethorpe county, large bowlders of granite are piled one on another. One of these, several tons in weight, is so nicely poised on a diagonal and central pivot that a slight rocking motion is easily given to it. In their composition these granites vary greatly, those of Oglethorpe and Elbert being very fine-grained and siliceous, with small specks of black mica, while those of other counties are coarse and more feldspathic. In Greene county the feldspar is in coarse crystals. The productiveness of these lands is about the same as that of the large granite region.

Granite, with pink feldspar.—Another granite is found at points along the southern edge of the metamorphic region the feldspar of which is a pinkish color and very coarse and the mica a black biotite. It is found only in this lower belt, and then in small outcrops in Muscogee, Jones, Columbia, and other counties. This southern granite belt outcrops largely in Columbia county, extends from Warrenton, beyond Sparta, nearly to Milledgeville, and is found in Muscogee county north of Columbus.

The following analyses are given of the granitic lands of Clayton, Lincoln, and Hancock counties:

No. 288. *Sandy mulatto soil*, 1 mile north of Jonesboro', Clayton county, taken to a depth of 6 inches, the soil itself being 3 inches and gray sandy. The growth is hickory, post oak, black-jack, and chestnut.

No. 142. *Gray sandy soil*, southwest from Lincolnton, Lincoln county, taken 6 inches deep. This soil has a growth of red and post oak, pine, and hickory. The subsoil of this (No. 143) was taken several inches deeper.

No. 170. *Ogeechee ridge gray sandy soil* from 11 miles northeast of Sparta, Hancock county, taken about 6 inches deep.

Granitic lands.

	Clayton county.	Lincoln county.		Hancock county.
	One mile from Jonesboro'.	Southwest of Lincolnton.		Eleven miles northeast of Sparta.
	Soil.	Soil.	Subsoil.	Soil.
	No. 288.	No. 142.	No. 143.	No. 170.
Insoluble matter	86.572	92.090	91.810	92.335
Soluble silica	3.441 } 90.013	1.220 } 93.310	1.190 } 93.000	1.455 } 93.790
Potash	0.240	0.110	0.154	0.099
Soda	0.081	0.085	0.024	0.020
Lime	0.080	0.090	0.062	0.175
Magnesia	0.064	0.025	0.058	0.025
Brown oxide of manganese	0.169	0.126	0.048	0.070
Peroxide of iron	2.171	0.963	1.715	1.438
Alumina	3.045	1.950	3.653	2.417
Phosphoric acid	0.232	0.191	0.105	0.145
Sulphuric acid	0.080	0.105	0.030	0.021
Water and organic matter	3.868	3.477	1.482	2.209
Total	100.034	100.391	100.331	100.409
Hygroscopic moisture	2.776	1.890	1.560	2.160
absorbed at	19 C.°	21 C.°	20 C.°	21 C.°

Between the soils of Lincoln and Hancock counties there is a strong similarity, except in the matter of lime and organic matter, there being nearly twice as much lime and one-third less of organic matter in those of the latter; but the soil from Hancock should perhaps be a little more fertile, because of the presence of even so little lime and the greater retentive power for hygroscopic moisture. The Lincoln subsoil is no better than the soil, though it has a little more potash. The amount of lime, phosphoric acid, and organic matter is less, and its retentive power is also less, though there is present a larger amount of clay and iron. One of the most striking features in all these analyses is the near agreement of the percentage of insoluble residue. The Clayton county soil is apparently superior in every respect, except in the proportion of lime.

A noticeable feature in the soils of the granitic region is the increase of both potash and lime over that of other metamorphic soils, both doubtless derived from the feldspars of the granite. The general average percentage of lime in the granitic lands, as shown by these analyses, is 0.102, an amount sufficient to make these lands thrifty and more durable than others. In the analysis of gray, sandy soils on page 33 the soil from Douglas county is apparently of granitic origin, and should perhaps be so classed.

THE FLATWOODS.—These comprise but a small area in Georgia, though they are largely represented in South Carolina. The largest belt is found entering from that state above the mouth of Broad river, passing with a southwest trend across Oglethorpe into the upper part of Greene county. In Elbert county the belt is from 5 to 7 miles wide, and has a dark-colored soil and a growth of black-jack oak. In other counties the belt is about 4 miles wide, and has a similar growth. The lands are very level, and in places large ponds of water are found. In some places the soil is said to be tough and like pipe-clay, with some gravel, and is almost useless for agricultural purposes; in wet weather boggy, and in dry as hard as a brick. A correspondent says of it: "The flatwoods have a black soil, with a yellow-clay subsoil, producing all the cereals finely and continuously, but making cotton successfully from four to six years after clearing; after that producing a sufficiency of weed, but not bolling, and ruined by rust."

The lands underlaid by the clay slates are not extensive in Georgia, and occur in small areas (as far as ascertained) along the southern edge of the metamorphic. The soils are sandy and not of that cold, gray, clayey nature represented in South Carolina.

CULTIVATED LANDS OF THE METAMORPHIC REGION.—In the high and mountainous district of the Blue Ridge region, especially in Towns and Rabun counties, there is a comparatively small amount of land suitable for tillage. The farms are small, and are found principally along the water-courses. In the entire group of ten counties but 12.3 per cent. of their area (or an average of 79 acres per square mile) is under cultivation.

The lands of the region have a dark or red loam soil, very rich and durable, those of the Little Tennessee valley, in Rabun county, being especially noted for their fertility and excellence; but in those counties which lie chiefly outside or south and west of the mountains the lands are gray, sandy, and gravelly, with a yellow or red clay subsoil. But little attention is given to the culture of cotton, because of (1) the distance from market and the absence of transportation facilities, and (2) the severe climate of the region and short seasons suitable to the growth

of cotton. The few cotton farms that do exist are usually found on the southern slopes of the hills, where they secure the direct warmth from the sun and protection against the north winds. The crop is also stimulated and hastened to maturity by the aid of commercial fertilizers. Farmers only plant a sufficient amount to provide for home use, the spinning-wheel and hand-loom being still in common use in these mountains.

Passing southward from the Blue Ridge counties, we find at first a small increase in acreage under cultivation, the average proportion in the counties of Franklin, Hart, Madison, Banks, Hall, Forsyth, Cherokee, and Pickens being about 38 per cent.; but beyond these, to the pine hills of the central cotton region, the general average of lands that have been or are now under cultivation is about 54 per cent. of the entire area.

The lands north of the Chattahoochee river, on the northeast, have almost entirely gray sandy soils, with but a few strips of red clay. The subsoils are almost universally clays. This section has been designated the "northeast division" by the state department of agriculture, and the yield per acre with fair cultivation is reported as follows: Corn, 20 bushels; wheat, 15 bushels; oats, 25 bushels; rye, 8 bushels; barley, 25 bushels; hay, from 2 to 3 tons; sorghum sirup, 75 gallons. Tobacco, buckwheat, and German millet can also be grown with great success. The fruits adapted to the section are the apple, cherry, pear, grape, plum in all its varieties, peach, gooseberry, raspberry, and strawberry.

In the rest of the metamorphic or "middle Georgia" region the products are—

> Cotton, corn, oats, and wheat, and all the grains and grasses, and even tobacco, may be grown successfully. After the coast country, this division was the first settled, and has continued to be the most populous in the state. A large proportion of the land has suffered temporary exhaustion by injudicious culture, which claimed everything from the soil and returned nothing; but this ruinous practice is fast giving way to a more enlightened and economical system. The abandoned fields grown up in stunted pines, and for from twenty to forty years considered useful only as pasturage, have been restored to cultivation, and are now among the most productive lands of the state.—*Georgia Department of Agriculture.*

The fruits to which this section is best adapted are the peach, fig, apple, pear, strawberry, and raspberry. The yield per acre of the common crops under ordinary culture is: Corn, 12 bushels; wheat, 8 bushels; oats, 25 bushels; barley, 30 bushels; rye, 8 bushels; sweet potatoes, 100 bushels.

The acreage devoted to cotton is naturally small in the northern counties near the Blue Ridge, and averages no more than 1 per cent. of the entire area under cultivation in a belt a few miles in width. Southward the acreage increases rapidly, until in the southern half we find that the percentage of the total area occupied by this crop is 10 to 15 on the east and 15 to 20 on the west, with three counties whose average is above 20 per cent., viz: Troup, Pike, and Clayton.

THE CENTRAL COTTON BELT.

The central cotton belt includes that broad strip of country extending across the center of the state in a slight south of west course from the Savannah river on the east to the Chattahoochee on the west, and is included between the metamorphic on the north and the long-leaf pine and wire-grass regions on the south. Its width eastward from the Ocmulgee river has an average of about 40 miles, but on the west of that river it widens, its southern limit passing in a southwesterly course, via Albany, to the southern part of Early county. Its extreme width along the Chattahoochee river is about 90 miles. The area embraced is about 6,835 square miles, and includes all of the following counties, viz: Richmond, Glascock, Washington, Wilkinson, Twiggs, Houston, Taylor (nearly), Macon, Schley, Marion, Chattahoochee, Stewart, Quitman, Webster, Sumter, Lee, Terrell, Randolph, Clay, and Calhoun; the lower or southern portions of Columbia, McDuffie, Warren, Hancock, Baldwin, Bibb, Crawford, Talbot, and Muscogee; the upper or northern portions of Early, Baker, Dougherty, Dooly, Pulaski, Laurens, Johnson, Jefferson, and Burke, and the eastern part of Screven, along the river—all of twenty and parts of nineteen counties.

Within this central cotton region there are three distinct belts, differing very widely from each other. These are: First, the *sand-hills and pine belt* on the north, and bordering the metamorphic region of the state, its sands also often extending northward and covering some of its rocks; second, the *red hills*, adjoining the first belt on the south; third, the *oak, hickory, and pine, sandy loam uplands*, with clay subsoils, forming, as it were, a transition belt from the red hills to the sandy wire-grass region of the south, and gradually falling in elevation from the hills to the level lands of the latter.

THE SAND AND PINE HILLS.

The records of the state geological survey place the northern limit of this belt from a few miles north of Augusta and Thomson, a few miles south of Warrenton and Sparta, to Milledgeville, Macon, Knoxville, Geneva, and Columbus, at which points the metamorphic rocks are found outcropping in the beds of the streams, while the sand-hills extend northward a short distance along the uplands. The southern limit is easily defined by the somewhat abrupt red clay hills along its border. Its width varies greatly, but is greatest on the east and west, about 25 or 30 miles from each of the large boundary rivers. Between the Ogeechee and Flint rivers it is rather narrow, but widens to the west to 20 miles or more in Taylor and Marion counties. On the Chattahoochee river its southern limit is near the mouth of Upatoi creek. The area embraced in the sand-hills is about 2,950 square miles.

The surface of the country embraced in this belt is high and rolling, and this is especially the case near its northern limit, where the altitude is from 500 to 600 feet above the sea, and sometimes 100 feet or more above the

adjoining metamorphic region. Southward the country falls to the foot of the line of red hills, which often rise abruptly from its limit. Again, in other localities, as between the Flint and Ocmulgee rivers, the lower part of the belt presents a broad plateau, which gradually declines southward. In the western portion of the belt the transition to the red hills is gradual. The country is very hilly and broken, with a height of from 100 to 150 feet above the streams, and is interspersed with deep gullies, formed by the washing away of clays and sands.

This belt is characterized by deep beds of white sands and gravel overlying white and variegated clays, with ledges of a gritty and micaceous mass, called by Professor Lyell "decomposed granite". Heavy beds of rounded quartz pebbles, sometimes containing tourmaline and other minerals, are found chiefly along the streams. Yellow ferruginous sandstone, sometimes approaching an iron ore in composition, and rounded concretions filled with sand, are found over the surface of the belt and in great abundance in some of the counties. From the Flint river to the Savannah on the east, where the belt is comparatively narrow, the beds of sand and clay deposits are deepest, and where exposed by railroad cuts or excavations show the irregular "flow and plunge" structure. The sand has a depth of 10 or 15 feet, and overlies from 100 to 200 feet of white or variegated colored clays, while on the west of Flint river the latter is only about 50 feet deep, overlaid by thick deposits of red and white sands.

The usual timber growth of these sand-hills is long and short-leaf pine, scrub black-jack oak, sweet gum, and some dogwood. Along the streams there is an undergrowth of bay and gallberry bushes, while their soil is but little less than sand, darkened more or less by decayed vegetation.

The lands of the sand-hills region have a soil of white sand from 6 to 12 inches deep and usually a sandy subsoil underlaid by variegated clays, and are not very productive, except where fresh or highly fertilized. The yield after a few years' cultivation is only about 200 pounds of seed-cotton per acre, but on the best lands it is 300 pounds. A large proportion of the lands originally in cultivation now lies "out".

RED HILLS.

A region of red hills occupies a narrow and interrupted belt, 4 or 5 miles wide, southward from the sand-hills region, and passes through the northern part of the counties of Burke, Jefferson, and Washington, the middle of Wilkinson and Twiggs, and the southern part of Houston to Flint river. West of that river, in the counties of Macon, Schley, Sumter, Webster, Stewart, and Randolph, the red clay lands are found scattered over a large territory, and, with the exception of a few large areas, they are rather in patches, being frequently covered by the white sands of the yellow-loam region.

The continuity of the belt throughout is broken by these sand-beds, especially on the west of Flint river, where the sands are deeper and more generally distributed. The red-hills region is characterized by a high rolling or broken and well-timbered surface, covered with deep red clay lands, more or less sandy, and having a thickness of from 20 to 50 feet, including siliceous fossil shells and rocks, and sometimes beds of greensand.

On the extreme east, in Burke county, the hills have an altitude of over 300 feet above the sea and 175 above Savannah river. Their red clays are covered by sands within a few miles of the river, and only outcrop in the bluff and on the sides of the hills. Silver bluff seems to be the most northern point of exposure of these ferruginous clays, the country northward being covered with the sands and white or variegated clays of the sand-hills region, while southward it gradually falls and becomes more sandy, the exact limit between this and the sandy yellow-loam belt being impossible to define. Much buhr-stone is found in fragments over the surface of this county.

Westward, in the counties of Jefferson and Washington, the country is more and more level until near the Oconee river, where the high lands are cut through to a depth of 150 feet by the streams, and form broken and abrupt hills facing the bottom lands.

Still westward, through the county of Wilkinson, this broken and hilly character continues, the sides of the ridges between the streams showing outcropping marls and limestone. The summits of the hills are frequently covered with red clays, which are also exposed on the south and east slopes, these sides being rather steep, while on the north and west the decline is more gentle, and is usually covered with sand and a timber growth of pine, with here and there small prairie patches of a black tenacious soil.

Still to the westward, in Twiggs and Houston counties, the red hills continue with broad summits and more or less sand. In the latter county they are in some places abrupt or bold on the north, facing the sand-hills belt, with gradual descents southward. The small patches of black prairie lands also occur in these counties. On the west of Flint river the country is much more sandy, with variegated and plastic clays covering hard limestones to a greater depth.

The red lands are very generally associated with siliceous shell-rocks and friable ferruginous sandstones, and, as before stated, are found in isolated areas over the entire yellow-loam region. The beds have a thickness of 60 feet at Shell bluff, on the Savannah river, and 50 feet at Fort Gaines, on the Chattahoochee, but between these two points they thin out to 10 or 20 feet as they approach the central Atlantic and Gulf water-divide.

Soils.—The lands of these red clay hills are usually somewhat sandy, and have a depth of from 12 to 24 inches in the eastern counties and from 6 to 12 inches in others. The subsoil is a heavy clay loam, deeper in color than the soil and more clayey, which sometimes overlies a variegated and plastic pipe-clay. The growth is oak, hickory, short-leaf

pine, and dogwood, with beech, maple, and poplar on the lowlands. The lands of the belt lying between the Savannah and Flint rivers are considered the best of the region, and not only occur in larger areas, but are more productive and durable, and are easily tilled. The subsoil is stiff and tenacious and hard to "break up". The lands yield from 800 to 1,000 pounds of seed-cotton when fresh, and 500 pounds after a few years' cultivation. Reports give the product after 50 years' cultivation as 300 pounds. These lands are, however, preferred for small grain.

West of Flint river the red clay lands of southern Stewart, Webster, and Randolph counties have similar productiveness and durability; but the more sandy of the red lands, while having, when fresh, a yield equal to the above, are not as durable. After five or six years' cultivation they produce only about 250 pounds of seed-cotton per acre. The red hills of Chattahoochee, Marion, Quitman, and the northern part of Stewart county are chiefly red sandy clays or red sands, from the large amount of red ferruginous sandstones that lie scattered on the surface of the hills or form beds and ledges. The underlying strata are variegated clays and blue-clay marls. This portion of the belt is, however, so broken, that for the most part only the low valley lands, with thin dark soils, are under cultivation.

There are isolated areas of these red clay lands north and south of the main red-hills belt, a few of which are marked on the map. The most prominent of these is that of Rich Hill, in the pine and sand hills adjoining the metamorphic, a few miles southeast of Knoxville, Crawford county. The summit of this hill is some 200 feet above the surrounding country, and its bed of red clay, 50 feet thick, can be seen for miles. Underlying it is a bed of coral marl (Tertiary) and from 50 to 75 feet of variegated and joint clay. Deep white sands cover the adjoining hills and ridges.

The composition of these lands is shown in the following analyses of soils taken from various points in the belt by the state survey:

Nos. 361 and 362. *Mulatto soil* and *red subsoil* from 5 miles north of Louisville, in Jefferson county. These are, perhaps, fair samples of the eastern half of the belt. The soil is sandy, and was taken 6 inches deep. The subsoil, while more clayey, is not properly a clay. The depth to which it was taken is not known.

No. 266. *Red hill soil* from Dr. S. S. Byrd's place, 3 miles south of Americus, Sumter county, taken 10 inches deep. Buhr-stone fragments, covered with quartz crystals and containing fossil-shell cavities, are in great abundance on the surface of the low hills and in the soil.

No. 166. *Red clay soil*, taken southwest of Lumpkin, Stewart county. This represents a large body of red land covering the high and rolling country. It was taken 6 inches deep. Ferruginous sandstone is abundant over the surface of these hills.

No. 322. *Dark sandy upland soil* from a few miles east of Fort Gaines, Clay county, taken 6 inches deep. Timber growth, oak, hickory, and long-leaf pine.

No. 323. *Red sandy subsoil* of the above is rather compact, and overlies a variegated or "calico" clay.

Red-hill lands of the central cotton region.

	Jefferson county.		Sumter county.	Stewart county.	Clay county.	
	5 miles north of Louisville.		3 miles south of Americus.	6 miles southwest of Lumpkin.	4 miles east of Fort Gaines.	
	Soil.	Subsoil.	Soil.	Soil.	Soil.	Subsoil.
	No. 361.	No. 362.	No. 266.	No. 166.	No. 322.	No. 323.
Insoluble matter	92.730	86.872	84.501	73.422	90.230	91.330
Soluble silica	1.383 } 94.113	3.724 } 90.596	1.699 } 86.200	2.709 } 76.131	1.940 } 92.170	2.350 } 93.680
Potash	0.180	0.330	0.075	0.134	0.067	0.047
Soda	0.095	0.145	0.068	Trace.	0.009	0.034
Lime	0.110	0.120	0.081	0.219	0.119	0.086
Magnesia	0.075	0.110	0.177	0.289	0.090	0.087
Brown oxide of manganese	0.158	0.220	0.082	0.164	0.313	0.167
Peroxide of iron	1.188	2.016	3.013	4.054	1.927	2.442
Alumina	1.770	3.941	6.507	10.598	2.141	2.295
Phosphoric acid	0.128	0.224	0.066	0.069	0.111	0.084
Sulphuric acid	0.348	0.273	0.041	0.035	0.054	0.166
Water and organic matter	1.511	1.646	4.193	8.309	2.881	0.993
Total	99.676	99.621	100.503	100.002	99.882	100.081
Hygroscopic moisture	1.673	2.163	4.372	7.510	2.906	2.222
absorbed at	16 C.°	16 C.°	20 C.°	16 C.°	14 C.°	15 C.°

The soil and subsoil from Jefferson county shows the greatest percentages of plant-food, both potash and phosphoric acid being present in reasonable amounts, with enough lime to act upon them for a few years. The percentage of sulphuric acid is extremely large. The Sumter county soil percentages are low, as is natural in a country full of siliceous rocks. The phosphoric acid is very close to the limit of deficiency. The Stewart county sample is an improvement on the latter in having a greater percentage of potash and of lime, the latter being sufficient for the present to act on the low percentage of phosphoric acid. The Clay county soil is richer than the subsoil, the latter being largely deficient in potash, lime, and phosphoric acid. The moisture coefficient is very low, which is unnatural in lands of this color.

THE OAK, HICKORY, AND LONG-LEAF PINE HILLS OR YELLOW-LOAM REGION.

This region forms a belt of country across the state between the Savannah and the Chattahoochee rivers, and extends in width from the sand-hills south to the pine-barrens and wire-grass region. Its width varies greatly. Between the Savannah and the Ocmulgee it is narrow, and is confined almost entirely to the country south of the red hills, from 15 to 25 miles. Westward to the Flint river it is wider, and in Houston county the lands are found north of the red hills. On the west the area widens still more, one narrow belt extending southwest to Albany, while the lower limit of the rest of the region extends to the Alabama line a few miles north of Fort Gaines, and the northern passes west to the Alabama line at the mouth of Upatoi creek. The entire area embraced by the yellow-loam region, including the red hills, is about 6,650 square miles.

Eastern division.

TOPOGRAPHY.—The surface of the country between the Savannah and the Flint rivers, while very broken in some localities, is generally rolling, with ridges parallel to the streams, and a timber growth of long-leaf pine, post and Spanish oaks, and hickory. The long-leaf pine is the most prominent, and in many places is almost the exclusive timber.

In some of the counties, notably in Twiggs, Jefferson, and Burke, there are a few large areas of what are termed "oaky flatwoods", level uplands with a yellow clay soil, mostly free from the sands that generally cover it elsewhere in the region, which have a prominent growth of post and red and black-jack oaks, hickory, and some long-leaf pine.

This yellow-loam belt extends southward along the larger streams into the wire-grass region in Screven county, and occupies narrow areas, with a growth of oak, hickory, etc. Along the Savannah river the belt extends as far south probably as Sister's ferry, in Effingham county; but the growth there is chiefly black-jack oak.

Red and yellow loam lands are found along the slopes of the pine hills adjoining the streams and their valleys, and the entire area represented in Screven county forms about one-tenth of its surface.

This belt or region is underlaid at from 3 to 10 feet by the same bed of soft limestone and marl found under the red hills and already described. It outcrops along the streams, and is easily accessible. Red-clay beds are frequently found below the subsoil and exposed on banks of streams or hillsides, though the latter are generally covered with sand. Siliceous rocks are abundant in fragments over the surface of the country, and among them are found opal, flint, buhr-stone, and the light aluminous or clayey variety. On the east, in Burke county, they form beds from 8 to 10 feet thick, and are the more compact rocks used for millstones. They seem to thin out to the west toward the Atlantic and Gulf water-divide in Houston county.

The soils of this eastern part of the belt are sandy and gray, except on the immediate surface, where they are dark from decayed vegetation. Black, brown, and yellow ferruginous gravel is abundant in some of the counties on the surface and mixed with the soil. The subsoil, at a depth of from 3 to 9 inches from the surface, is either a yellow-clay loam or yellow sand. Lands having the latter are poor and unproductive, except perhaps for a year or two, and are only kept under cultivation with fertilizers. The growth is almost exclusively the long-leaf pine.

The better class of soils, with their clay subsoils and mixed growth of long-leaf pine, oak, and hickory, are easy to cultivate and are well drained, and yield an average of 500 pounds of seed-cotton per acre when fresh and 250 or 300 pounds after a cultivation of ten years.

The oak and hickory upland soils of Houston county east of Fort Valley differ from the general class in being often thin and underlaid by a white and variegated pipe-clay. Ferruginous sandstone is abundant in localities, and the growth is pine, oak, hickory, gum, elm, and persimmon. Spots of red lands occur occasionally.

Western division.

West of Flint river these lands cover the greater part of the oak and hickory region. The upper counties, and those along the Chattahoochee river as far south as Clay county, are hilly, and are usually covered with a heavy deposit of sand. Underneath the sandy soil are the red and yellow clays over variegated and joint clays with Cretaceous marls. The growth of these hills is oak and hickory, with a large proportion of short- and long-leaf

pine, which also characterize these lands southward. Ferruginous sandstone is abundant in some localities on high points. These lands are but sparingly under tillage, owing to their broken character and to the abundance of good valley lands.

Going southward from these hills the country becomes more level, and the soil is a finer loam. The clay subsoil is covered by the sandy deposit to a much less depth, and buhrstone is found in fragments. There are large areas of level uplands in Sumter, Webster, and Stewart counties, in the lower parts of Macon, Schley, and Marion, and in the upper parts of Lee, Terrell, Randolph, and Quitman. In these counties the clays are underlaid by a hard limestone, outcrops of which are seen in the bluffs of the Chattahoochee south of Pataula creek, Clay county, in the caves of Randolph county north of Cuthbert, and in the bluffs of Flint river at Montezuma. Pine, oak, and hickory also characterize the growth of this section.

Going still farther south, into the counties of Clay, Early, Calhoun, Terrell, and the lower part of Randolph and Sumter, we find the lands very level, except along the river. The sandy soil is still more shallow, and the red or yellow-clay subsoil often comes to the surface, forming by admixture a mulatto soil sometimes 10 inches in depth. Long-leaf pine becomes more abundant and the growth more open. Lime-sinks are found, and underground streams frequently are seen flowing through them. Streams disappear suddenly and as suddenly reappear miles away. The rock, when exposed, is found to be a very white and soft limestone, composed largely of small corals and shells, as in the eastern counties. The largest exposure of limestone is along the Chattahoochee river at Fort Gaines and southward for 30 miles or more.

Siliceous shell-rock, varying in character from hard flint to soft, powdery material (fossiliferous), is abundant and overlies the limestone. Silicified wood also occurs in many places, some of the logs having large diameters and cavities thickly lined with small quartz crystals.

On the east of these pine hills, and between them and the wire-grass country, is a belt of oak, hickory, and pine uplands very similar in every respect to the northern portion of the region. This belt comprises the western half of Dougherty, central portion of Lee, and northward. The soils are largely sandy, with red or mulatto clays interspersed in large bodies throughout.

The yield of the fresh lands of the upland region, as claimed by correspondents with but few exceptions, is from 600 to 800 pounds of seed-cotton per acre, or from 250 to 400 pounds on lands of several years' cultivation. There is, however, some difference between the enumeration results in the eastern, middle, and western portions of the region, the product per acre ranging from 470 or 500 pounds in Burke and Washington counties to 424 in Pulaski and 399 in Twiggs, while on the west it varies from 414 in Chattahoochee to 300 in Early county.

The following analyses of samples from different counties show the composition of the lands of the oak, hickory, and pine uplands:

No. 359. *Gray sandy soil*, taken near Bushyville, a few miles from Fort Valley, Houston county. Depth, about 6 inches; growth, not given. The yellow sandy subsoil (No. 360) was taken a few inches deeper.

No. 252. *Dark sandy soil* from J. Shep. Green's place, near Chokey creek, in the northeastern corner of Lee county. Depth, 6 inches; white marl beds underlie these lands at a few feet.

Oak, hickory, and pine uplands.

	Houston county.		Lee county.
	Soil.	Subsoil.	Dark sandy soil.
	No. 359.	No. 360.	No. 252.
Insoluble matter	90.681	88.990	92.460
Soluble silica	1.885	1.985	1.550
	92.566	90.975	94.010
Potash	0.275	0.200	0.095
Soda	0.130	0.061	0.036
Lime	0.055	0.065	0.076
Magnesia	0.048	0.067	0.083
Brown oxide of manganese	0.172	0.061	0.040
Peroxide of iron	1.837	1.860	0.843
Alumina	1.436	3.282	2.649
Phosphoric acid	0.105	0.102	0.039
Sulphuric acid	0.034	0.085	0.045
Water and organic matter	3.682	2.580	2.354
Total	100.340	99.338	100.270
Hygroscopic moisture	2.966	4.188	2.125
absorbed at	16 C.°	16 C.°	21 C.°

One of the most striking features of these soils is their low percentages in lime and phosphoric acid. The percentage of potash in the Houston county soil is respectable, but is not so in the others. That the application of

lime in all of them is of the first importance is very apparent to render available what little phosphoric acid there is. In the case of the Lee county soil, this lime from the underlying marl-bed was applied a few years ago on the farm adjoining the timbered spot where the soil analysis was taken, resulting in a large increase in the cotton yield after the first year. An excellent white limestone and indurate marl occurs, underlying nearly the entire region, and is easily accessible. Still better than marl alone would be a compost of marl and fertilizers containing both potash and phosphoric acid, as the amount of each of them that now occurs in the soil would soon be exhausted by liming alone.

SOUTHERN OAK, HICKORY, AND PINE REGION.

The region embraced in this division comprises portions of the counties of Decatur, Thomas, and Brooks, lying along and near the Florida line. The country for the most part is high and rather rolling, and is about 75 feet above the open wire-grass country on the north or 130 feet above the river. In Decatur county it presents a bolder front to that region than in the other counties, the ascent along the line from a point 7 miles south of Bainbridge, thence eastward to near Attapulgus and northward by Climax, being quite abrupt. Eastward it gradually assumes the wire-grass feature, and the line of separation is not so well marked.

The area embraced in this southern region is estimated to be about 2,317 square miles. The surface of the country is for the most part very open, with a tall timber growth of long-leaf pine.

The soil is very generally sandy, from 6 to 12 inches deep, with mostly a clayey subsoil, underlaid by white limestone. A peculiar feature of the region is the presence of a red clay loam in small localities where the timber growth is oak and hickory. Wire-grass occurs but seldom in this region, and siliceous shell-rocks are almost entirely absent, except in some lowlands. The yield is reported to be from 600 to 800 pounds of seed-cotton per acre after four years' cultivation.

The following analyses show the composition of some of the lands of this region. The subsoils, unfortunately, were not taken in every case:

Nos. 307 and 308. *Gray sandy soil* and *subsoil*, taken, respectively, at 6 and 6 to 9 inches depth from the oak and hickory lands at Ocopilco, northwest of Quitman, in Brooks county. Sarsaparilla in abundance.

No. 165. *Gray sandy soil*, taken near Thomasville, Thomas county, 6 inches deep. Timber growth, long-leaf pine.

No. 161. *Sandy soil*, taken 15 miles southwest of Thomasville, Thomas county. Timber growth, long-leaf pine, oak, and hickory.

No. 182. *Hummock soil*, taken near Barrows' mill, in the northeastern corner of Decatur county, underlaid by limestone.

Lands of the southern oak, hickory, and pine region.

	Brooks county.		Thomas county.		Decatur county.
	Ocopilco church.		Thomasville.	15 miles southwest of Thomasville.	Barrows' mill.
	Soil.	Subsoil.	Soil.	Soil.	Hummock soil.
	No. 307.	No. 308.	No. 165.	No. 161.	No. 182.
Insoluble matter	94.428	80.070	94.822	92.726	91.544
Soluble silica	0.529	5.528	1.037	0.701	2.367
	94.957	85.598	95.859	93.427	93.911
Potash	0.209	0.255	0.084	0.042	0.068
Soda	0.069	0.114	0.022	0.042	0.008
Lime	0.141	0.046	0.045	0.019	0.052
Magnesia	0.031	0.025	0.043	0.016	0.051
Brown oxide of manganese	0.101	0.089	0.020	0.108	0.047
Peroxide of iron	0.661	2.172	0.930	1.427	1.130
Alumina	1.195	4.551	1.576	1.780	1.090
Phosphoric acid	0.103	0.183	0.014	0.021	0.243
Sulphuric acid	0.046	0.025	0.035	0.026	0.028
Water and organic matter	3.113	2.829	1.636	3.099	2.924
Total	100.626	95.887	100.214	100.007	99.552
Hygroscopic moisture absorbed at	1.705 21 C.°	3.797 22 C.°	1.562 21 C.°	2.180 12 C.°	2.630 17 C.°

A marked difference is readily observed in the soils of Brooks and Thomas counties. The soil and subsoil from Brooks are by far the richer in both potash, phosphoric acid, and lime, though even they do not contain more than fair percentages of each. The locality from where the samples were taken (northern part of Brooks) has more of the

character of the lands of the central region than the soils of Thomas county, and there is a comparatively sparse growth of long-leaf pine. The samples from Thomas county, on the contrary, are from localities where the long-leaf pine is abundant, and the soils resemble more those of the long-leaf pine region proper in their great deficiencies in potash, lime, and phosphoric acid. The hummock soil of Decatur, probably a fair representative of all of the hummocks of the southern part of the state, is rich in phosphoric acid, but deficient in all other important elements, including even the vegetable matter, whose percentage is usually much larger.

Lowlands of the central cotton belt.

These comprise the bottoms and hummocks of the streams and gallberry flats. The bottoms of the larger streams are usually liable to yearly overflows, and are therefore but little in cultivation. Their width varies from 200 to 1,500 yards, and even more in the sharp bends of the streams. The growth is usually pine, oak, hickory, bay, poplar, maple, beech, gum, etc. The soil is a dark loam, more or less sandy, red in some of the streams, and from 1 foot to 6 feet deep to a tenacious pipe-clay.

On the Chattahoochee river there is but little bottom land proper, the uplands approaching to the water's edge and forming bluffs. As cotton crops on all of the bottom lands are liable to injury from early frosts and rust, corn and oats comprise the chief crops.

The gallberry flats are lowlands along the very small streams, which have a light sandy soil and a dense growth of gallberry bushes about 3 feet high and a larger growth of titi, cassino, small bays, and a few cypress. They are somewhat marshy, and are not under cultivation.

The hummocks, or second bottoms, of the larger streams above overflow are largely under cultivation, and on some of the streams are very extensive. They are very level, and have a growth similar to the bottoms. The soil is a rich sandy loam from 12 to 24 inches deep, with much decayed vegetation, and is considered the most productive of all the lands of the belt. An analysis of a hummock soil from Decatur county is given on page 43. Of seed-cotton these hummock soils yield about 1,400 pounds when fresh and from 800 to 1,000 pounds after being cultivated a few years. Heavy clays also underlie the lands. These lands are, however, not considered best for cotton, that crop being liable to injury from early frosts and rust, though large crops are produced. They are said to be late, cold, and ill drained.

The alluvial lands of the Savannah river are very level and wide, and have a growth of beech, white and water oaks, hickory, ash, holly, bay, birch, walnut, mulberry, sycamore, and cottonwood. The soil, a fine brown loam mixed with scales of mica, is from 2 to 3 feet deep, with a putty-like, tenacious pipe-clay, which is hard to till and "breaks up in clods". These lands are largely under cultivation, being well adapted to cotton, corn, and grain, though the former suffers much from rust and early frosts. The yield in seed-cotton is about 1,500 pounds on fresh land and 1,000 pounds after a few years' cultivation, and unless prevented by having the rows far apart, or by other means, it grows to a height of 5 or 6 feet. Very little of this land lies out.

Along the Chattahoochee river, south from Columbus to Georgetown, there are many level valleys of open prairie occupying a position similar to the second bottoms of other streams, but higher, and without their growth. In Muscogee county these valleys are very broad and open, and have a fine sandy loam soil from 5 to 12 inches deep and a heavy clay subsoil.

In the counties south, where the blue-clay marls approach near the surface, these prairie valleys are richer, the soil being darker and more tenacious. The sand and red clays of the adjoining hills enter more or less into its composition. In the southwestern part of Stewart county this valley is two or more miles wide. The lands under cultivation yield from 800 to 1,200 pounds of seed-cotton per acre when fresh and from 600 to 800 pounds after five or ten years of constant tillage.

On the eastern side of the state, in Burke and Screven counties, there are a number of ponds, some of them covering many acres each, which were once drained and brought into cultivation. The soil, while black from the long accumulation of decayed vegetation, was soon found to consist largely of a fine dust or silt, which, when dry, was very light. On being stirred up by plows or hoes this dust rose in the air, and by inhalation so irritated and injured the throats and lungs of the workmen that the fields had to be abandoned. This dust is derived from the siliceous and flinty rocks that usually are found in heavy beds on the borders of these ponds. Examinations of these rocks with the microscope by Lyell revealed the presence of very minute siliceous sponge spicules, with sharp, needle-like points. The rocks, by their disintegration, have formed this fine and light dust, white, or sometimes red from the presence of a little iron, and it is these spicules which have done the injury to the workmen.

Marls and limestone.

Throughout the central cotton belt there occur extensive beds of marl and limestone beneath the sands and clays of the hills often exposed along the banks and bluffs of the streams. The marls, composed of a mass of comminuted shells, are especially valuable agriculturally, because of their richness in lime, and sometimes in potash and phosphoric acid. They vary greatly in the thickness of their beds and in their character and composition, and mostly belong to the class of stimulant manures that serve by their lime to make available for plant use the food elements that exist in the soil in an insoluble condition. There are also other beds containing much greensand (glauconite), rich in potash and valuable as a nutritive manure.

The marls belong to the two geological formations, Cretaceous and Tertiary, and their localities and characters have, to some extent, been examined by the state geological survey. Analyses have been made of some of the chief beds, and the results are given below, as taken from the *Hand-Book of Georgia.* (*a*)

Cretaceous marls.—The beds embraced within the Cretaceous region south from Columbus are generally of a bluish micaceous character, and contain comparatively little lime, usually from 4 to 6 per cent., and are therefore hardly worth the cost of removal to any distance. The shells they contain are in a good state of preservation, and in the beds on Pataula creek, Clay county, they are far more abundant than farther north, in Chattahoochee county, or eastward from the Chattahoochee river. Their greatest exposure is along the river from the mouth of Upatoi creek, Muscogee county, to that of the Pataula, in Clay county, the beds having a thickness above the water's edge of from 15 to 20 feet. In some places there occur beds of a stiff clay, yellowish or slightly bluish in color, in which the shells are of a firmer character and less broken and the clay apparently less calcareous, though still properly belonging to the class of marls.

In both blue and yellow clay marls there is much decomposing iron pyrites, which tend to render the mass more or less acid in character, and therefore unfit for fertilizing purposes.

The following analyses have been made of samples of blue marl from a few localities:

No. 1. *Blue marl* from "the narrows", Pataula creek, Clay county, dark bluish-gray color, a friable mass of shells and calcareous fragments mixed with fine, dark-colored earth—micaceous, the small particles of mica giving it a glistening appearance, and slightly acid in reaction, hence dangerous to use alone, and should be mixed with a small amount of caustic lime or purer marl before application.

No. 2. *Blue marl* from near Hatchie station, Quitman county, of a light bluish-gray color, coarsely granular and friable, containing sand and pebbles, and slightly acid in reaction.

No. 3. *Blue marl* from Bagley's mill, Chattahoochee county, in general appearance and properties very similar to No. 1.

Blue marls (*Cretaceous*).

	CLAY COUNTY.	QUITMAN COUNTY.	CHATTAHOOCHEE COUNTY.
	Pataula creek.	Hatchie station.	Bagley's mill.
	No. 1.	No. 2.	No. 3.
Sand	71.112	72.191	70.919
Soluble silica	2.213	0.123	0.321
Potash and soda	0.146	0.108	0.158
Lime	4.891	7.740	5.551
Magnesia	0.158	Trace.	0.162
Oxide of iron	5.108	4.106	4.982
Alumina	2.142	1.541	2.321
Phosphoric acid	0.315	0.121	0.231
Sulphuric acid	0.543	0.312	0.430
Carbonic acid	3.740	6.081	4.362
Organic acid	7.312	5.352	8.121
Water	2.450	2.421	2.560
Total	100.130	100.096	100.118

The comparatively small amounts of lime (for marls), and of potash, soda, and phosphoric acid, are readily observed in the above, while at the same time the acid character is shown in the large amounts of sulphuric acid, which probably occurs, combined with some of the iron, as copperas.

Blue greensand marl.—There is, however, an extensive bed of blue marl along the banks of the Chattahoochee river in Stewart county which is rendered valuable by its greensand character. It occurs in a bed exposed some 15 or 20 feet, and for many miles along the river dips to the southwest, and finally disappears below the water. A complete analysis has not been made of this marl, but a test for potash alone showed the presence of from 1 to 2 per cent. of that element.

Tertiary marls.—The Tertiary marl-beds are far more extensive, as well as more valuable, than are the Cretaceous beds. They are generally a white and friable mass of broken shells and fine corals, and are so compact as to form almost perpendicular bluffs where exposed on the larger streams. This is especially the case with the lower or Claiborne beds, which occur at Fort Gaines, Clay county, forming there a bed 25 feet or more thick, and in turn overlaid by bluish fossiliferous clays, and still higher by 50 feet or more of red loam. A white limestone underlies it. This marl has numerous outcrops eastward to the Savannah river, where thick beds occur at the foot of Shell bluff and at Silver bluff. It contains usually as much as 95 per cent. of carbonate of lime, and is well worth transportation

a A publication by the state department of agriculture, 1876. The analyses were made by Professor W. C. White, of the University of Georgia.

to the farms of the region and elsewhere. Its use upon the soil has been attended with a large increase in productiveness, as attested by several farmers in Lee county. When used broadcast on the land, its effects are not usually apparent in the first year's crop; but afterward it produces a marked and continuous improvement, provided there are fair amounts of potash and phosphoric acid already present in the soil.

The following analyses are selected to show the average composition of these marls:

No. 6. *Marl* from Shell bluff, Burke county. This marl has a faint brownish tinge, and is coarsely granular and friable, showing fragments and impressions of shell. A similar marl at Sapp's mill, in this county, contains more lime and 0.251 per cent. of phosphoric acid.

No. 5. A nearly pure *white marl* from Reddick's quarry, Screven county, coarsely granular and friable, similar to No. 6. Another bed at Crockett's spring, in the same county, contains the same percentage of lime, but less phosphoric acid (0.045).

No. 3. *Dark-brown marl* from Mrs. Longstreet's, Effingham county, a mass of coarsely comminuted shells, mixed with sand, pebbles, etc.

No. 1. *White marl* from 2 miles north of Tennille or Station No. 13, Central railroad, coarsely granular, friable, and dry. Contains fragments of fossil bones.

No. 17. *Light buff-colored shell marl* from Houston county (locality not given). This is one of three specimens analyzed, a notable feature being the very high percentages of phosphoric acid in each, viz, 0.758, 0.894, and 1.012. They have nearly the same percentages of lime, sand, iron, and alumina.

No. 13. *Shell marl* from the plantation of J. S. Odom, near Montezuma, Macon county, light colored, friable, and coarsely granular.

No. 18. *Dark-colored marl* from the neighborhood of Albany, Dougherty county, loose and pulverulent.

White marls (Tertiary).

	BURKE COUNTY.	SCREVEN COUNTY.	EFFINGHAM COUNTY.	WASHINGTON COUNTY.	HOUSTON COUNTY.	MACON COUNTY.	DOUGHERTY COUNTY.
	Shell bluff.	Reddick's quarry.	Mrs. Longstreet's.	Near Tennille.		Near Montezuma.	Near Albany.
	No. 6.	No. 5.	No. 3.	No. 1.	No. 17.	No. 13.	No. 18.
Sand	8.412	7.321	65.620	5.320	13.551	12.642	14.008
Soluble silica	1.216	1.582	0.612	0.984	0.314	1.215	0.435
Lime	46.763	50.136	15.948	49.872	45.654	43.672	42.876
Magnesia	0.046	0.054	Trace.	0.120	0.075	0.035	0.145
Oxide of iron	4.310	3.218	2.380	1.654	2.082	3.025	2.654
Alumina	0.621	0.849	1.354	0.406	1.114	1.756	1.328
Phosphoric acid	0.125	0.132	0.075	0.782	1.012	0.028	2.574
Carbonic acid	36.521	37.054	12.452	39.215	34.874	34.122	31.958
Organic matter	0.752	0.658	0.256	Trace.	0.130	2.105	2.394
Water	1.314	1.231	1.168	1.628	1.194	1.450	1.628
Total	100.080	101.935	99.865	99.981	100.000	100.050	100.000

While all of the above marls are highly valuable because of their high lime percentages, those from Washington, Houston, and Dougherty counties are made more especially so by their additional very high amounts of phosphoric acid. The Dougherty county sample is extremely rich, and its extraordinary percentage of phosphoric acid is probably due to the presence of animal bones.

Greensand clays.—Overlying these beds of limestone and white marl in the counties of Twiggs, Wilkinson, and Houston are other beds of greensand clays from 12 to 24 inches thick. These contain, as shown by analysis, from 2 to 3 per cent. of potash, and are well worth removal to those farms whose soils are lacking in this element of plant-food. A complete analysis of the marl has not been made.

LONG-LEAF PINE AND WIRE-GRASS REGION.

This region covers a large portion of southern Georgia south of the oak and hickory and pine lands of the central cotton belt, extending from the Savannah river on the east to the Chattahoochee river on the west, and including in its area eighteen whole counties and large parts of others. The entire region is, as it were, a vast plain very nearly level, except on the north, and covered with a growth of tall long-leaf pine. Their large and straight trunks are devoid of branches for from 30 to 100 feet above the ground, and stand so far apart as to make an average of only from 50 to 75 trees per acre, with only here and there some undergrowth. In most of the region public roads are of use only as guides and a means of crossing any small streams that may come in the way, and to avoid the fallen timber that marks numerous storm tracks. Over large areas, where the lands are a dark sandy loam with yellow sandy subsoil, the roads are compact, hard, and smooth. Houses in this region are few, and the feeling of loneliness that steals

over a traveler passing through the "piny woods" for the first time is enhanced by the peculiar sighing of the breeze among the tree-tops. The roots of the pine tree do not penetrate to a great depth, but are rather inclined to spread out under the surface soil, and the trees are therefore easily uprooted and thrown to the ground by a wind that would scarcely affect another growth. As a consequence, the paths of destructive winds in the section are marked for many years by fallen timber, which lie parallel with the track or with the tree-tops toward its center. The hearts and knots ("lightwood") of the decaying pine timber are utilized for fuel (making quickly-lighted, durable, and hot fires), and also for light instead of lamps, by the backwoodsman. Lumber, turpentine, resin, and charcoal are prominent products. "Turpentine farms" of from 10,000 to 75,000 trees each are found throughout the entire region, and especially in the middle, eastern, and southeastern portions.

When once killed, either on cultivated lands or on burned areas, the long-leaf pine does not return, but is replaced by a stunted short-leaf species ("loblolly pine"). Large open tracts or "prairies" are now being farmed in this section of the state, the grass and undergrowth being yearly burned off.

The long-leaf pine, while one of the most prominent characteristics of the wire-grass region, is also found northward in small patches even as far as the Tennessee line, while north of the central cotton belt it becomes of smaller growth.

As might be judged from the name given to the region, its chief characteristic feature is the so-called wire-grass (various species of *Aristida*), that covers the entire region from the Savannah river westward to the Chattahoochee river and into Alabama. In many places it forms a thick "carpet" over the land, while westward especially it is not so dense. This wire-grass is, as its name implies, a long and round bladed grass, tapering to a sharp point, growing in large tufts, which bend outward on all sides, though quite stiff and upright for from 6 to 12 inches from the ground. In the spring, when young and tender, it furnishes excellent pasturage, and stock-raising is now becoming the chief industry of the region. As winter approaches the grass becomes coarse and tough. It is said to be easily choked out by the weed known as "dog-fennel", and whenever once destroyed, either by cultivation or otherwise, does not return. Another peculiarity is that it is never found on lands that are subject to overflow. It is also found in patches in the coast region and on the islands.

STREAMS.—The streams of the long-leaf pine and wire-grass region soon after they leave the oak and hickory belt become slow in their movement, and have banks from 25 to 30 feet high (showing on some of the streams heavy beds of sandstone), with bottom lands not very wide, having a growth of magnolia, bay, and titi. Southward they become slower in movement, with bottom lands increasing in width, and having banks only from 15 to 25 feet high. The small streams are usually very sluggish and dark from decayed vegetation. They often have little or no bottom land, and but for the undergrowth that skirts their low banks a traveler would hardly suspect their proximity until at their very edge. The saw-palmetto appears on the lowlands, while the pitcher-plant also covers large areas. The former increases in growth until it finally seems largely to displace the wire-grass in the coast and swamp counties. The growth of the bottoms in the lower section differs but little from that in the upper.

The surface of the upper and western portions of this region is somewhat rolling or undulating, with a few low ridges or hills, and is elevated from 25 to 50 or even 75 feet above the streams and from 200 to 500 feet above the sea. This is especially the case in the northeastern and southwestern portions of the region, which also differ from the rest in being underlaid by limestone ("lime-sink region") and having a better class of soil, as indicated by the occasional admixture of oak and hickory with the long-leaf pine.

The differences in the two regions mentioned are sufficiently great to justify a subdivision into what may be termed the "pine barrens" proper and the "lime-sink" divisions, the growth of long-leaf pine and wire-grass being still common to both. This entire wire-grass region is the special home of the gopher ("*Testudo polyphemus*"), whose holes are marked by the innumerable small hills of sand seen everywhere. The salamander (*triton sp.*) is also a native of this region.

THE LIME-SINK REGION.

The lime-sink region lies chiefly on the west of the Atlantic and Gulf water-divide. The soft limestone underlying this section, instead of the sandstone alluded to, is accompanied on the surface, and sometimes in beds, by masses of a siliceous and aluminous and often flinty shell-rock. The eastern limit of this lime-sink region is marked by a line of low ridges branching off southward from the main divide and separating the waters of the Allapaha and Withlacoochee rivers from those of the Flint river. This line passes through the eastern side of Worth and Colquitt counties, and southeastward into Brooks and Lowndes. The region embraces about 7,020 square miles, and includes the following counties and parts of counties: Screven, except a strip along the eastern and northern sides of the county; the lower part of Burke; the upper part of Bulloch; all of Miller, Mitchell, Colquitt, and Worth; the southern parts of Pulaski, Dougherty, Baker, and Early; the northern parts of Decatur, Thomas, Brooks, and Lowndes; the eastern parts of Dooly, Lee, and Dougherty; and the western parts of Irwin, Berrien, Dodge, and Wilcox.

In this lime-sink region the banks of the streams are from 50 to 75 feet high, and the bottoms rather narrow, with a growth of oak, hickory, walnut, magnolia, and dogwood. The water is generally clear, though not rapid in

movement. On the uplands the timber growth is almost exclusively long-leaf pine, except in the vicinity of the large streams, where oak is found to some extent. The country is very open, and resembles very much the pine barrens, though it is not as level.

The depressions of the surface, called "lime-sinks", are caused by the dissolution and wearing away of underlying limestone. Into one of these sinks sometimes a small stream falls and disappears, while in another the underground stream may be seen flowing past. In others the water is still and quiet, but rises and falls in conjunction with some neighboring large stream, thus showing underground connections. Ponds are also abundant, one of these, near Bainbridge, Decatur county, being 3 miles in circumference. Caves are often found associated with these sinks, and in some the great rush of air that either enters or comes from them has given to them the name of "blowing caves".

Agricultural features.—This is a better cotton-producing region than the pine barrens, and Decatur county was at one time reported to be even the "banner cotton county" of the state in total production. It is said that 4 per cent. of the land is irreclaimable swamp, and of the remainder over 26 per cent. has been cleared. Much of this is reported as now lying out; but 15.5 per cent. of the area is under cultivation, and of this 34.4 per cent. is in cotton.

The uplands of the region, with their long-leaf pine and wire-grass, have a gray, sandy soil, which is from 6 to 12 inches deep, and a red or yellow sandy clay subsoil, and contains some ferruginous gravel. These lands are less under cultivation than the other varieties, as they are not as productive or as durable. They yield at first from 500 to 800 pounds of seed-cotton per acre, but after eight or ten years, without fertilizers, this is diminished to 350 or 500 pounds. The country is so sparsely settled that the farms are located chiefly on the better classes of land.

The following analyses of soil and subsoil Nos. 500 and 501, taken near Sylvania, Screven county, may be considered a fair representation of the lands of the lime-sink division of the wire-grass region. The soil was taken 6 inches deep; the subsoil from 6 to 12 inches. Growth, long-leaf pine.

Long-leaf pine land, Screven county.

	Soil.	Subsoil.
	No. 500.	No. 501.
Insoluble matter	93.050 } 93.916	94.820 } 95.410
Soluble silica	0.866 }	0.590 }
Potash	0.320	0.102
Soda	0.168	0.051
Lime	0.129	0.043
Magnesia	0.116	0.033
Brown oxide of manganese	0.103	0.067
Peroxide of iron	0.672	1.090
Alumina	1.095	1.078
Phosphoric acid	0.125	0.112
Sulphuric acid	0.125	0.067
Water and organic matter	3.617	1.575
Total	100.386	99.628
Hygroscopic moisture	2.950	1.171
absorbed at	16 C.°	20 C.°

In this case the soil proves to be much richer than the subsoil in all the essential elements of fertility. There is a fair percentage of potash, phosphoric acid, and lime.

The *bottom lands* lying along the rivers and hummocks of the creeks have a dark loamy soil (alluvial), with a clay subsoil at a depth of from 10 to 20 inches. They are very durable, and yield from 800 to 1,000 pounds of seed-cotton per acre when fresh, and nearly the same after several years' cultivation. The growth on the streams is white and red oaks, ash, hickory, poplar, beech, bays, and magnolia; on the uplands, along the large water-courses, oaks are a prominent growth.

No. 504. *Black soil* from Brier creek near its junction with the Savannah river, in Screven county. This soil has a depth of from 1 foot to 3 feet, and, as its analysis below shows, contains over 29 per cent. of vegetable matter. Its native growth is chiefly cypress and black gum. The subsoil is either sand or a pipe-clay.

The soil of the uplands is sandy and gray or ash-colored, 12 inches deep, and has a subsoil of yellow or orange-colored loam. In the higher regions there is sometimes a clay subsoil approaching the surface, giving to the land greater fertility and durability, as indicated by the oak and hickory growth. The soil is frequently covered with gravel, either of quartz or of ferruginous concretions, yellow or dark-brown externally, and either smooth or rough, with a black interior. These latter are commonly known in some of the counties as the so-called "Georgia pills".

Both kinds are found in the upper portion of the region; but in the lower the ferruginous concretions only are observed, and then usually on the low hills. It has been noted that on lands containing these latter cotton is very liable to rust.

These sandy soils, while producing a very good crop of cotton when new and fresh, very soon wear out, and without the aid of fertilizers their cultivation is not profitable.

The yield in seed-cotton on fresh sandy uplands without the aid of fertilizers is about 500 pounds per acre, though some correspondents report more than this. After cultivation for several years, this is diminished to about 300 pounds of seed-cotton, or 100 pounds of lint, per acre. This, when sold, would bring only about $10, with a clear profit of only from $2 to $4 at the estimated cost of production and marketing. Of other crops, corn and oats yield 10 bushels per acre, while sorghum-cane does very well, and much attention is given to its cultivation.

The bottom lands in some counties are considered better than the uplands, but are more or less liable to overflow. In the northern section it is found that where cotton is cultivated it suffers from rust and is liable to be killed by early frost; hence corn is raised instead of cotton. The soil is very sandy, and is colored almost black by decayed leaves and other vegetation. Its depth is 12 inches or more, and it is sometimes underlaid by clay. The growth is poplar, cypress, and titi, with some pine and "fever-tree", or "Georgia bark" (*Pinckneya pubens*).

The second bottoms or hummock lands differ from the bottoms in being above overflow, but their other features are similar.

The following is the analysis of a fair sample of the *soil* and *subsoil*, Nos. 509 and 510, of the pine barrens. The specimen was taken in the "neck" of Telfair county, near Lumber City, by Captain C. A. Locke, of the United States engineer corps. Depth of soil, 6 inches; subsoil, from 6 to 12 inches. Growth, long-leaf pine and wire-grass.

Pine barrens and wire-grass land, Telfair county.

	Soil.	Subsoil.
	No. 509.	No. 510.
Insoluble matter	93.354 } 94.455	73.480 } 77.725
Soluble silica	1.101 }	4.245 }
Potash	0.094	0.251
Soda	0.078	0.169
Lime	0.022	0.035
Magnesia	0.156	0.326
Brown oxide of manganese	0.018	0.031
Peroxide of iron	0.974	4.418
Alumina	2.262	11.659
Phosphoric acid	0.039	0.024
Sulphuric acid	0.082	0.290
Water and organic matter	2.080	5.278
Total	100.260	100.206
Humus	0.836	.....
Available inorganic	1.298	.....
Hygroscopic moisture	1.968	8.752
absorbed at	15.5 C.°	15.5 C.°

Little can be said of this soil except that it is very poor in all the elements of fertility. A rather remarkable feature of the subsoil is, that although containing so much clay (iron, alumina, and soluble silica) its amounts of phosphoric acid and lime should be so deficient. Its water and organic matter are also large for a subsoil, while its percentage of potash is fair.

PINE AND PALMETTO FLATS.

The region thus designated lies in the southeastern corner of the state, around Okefenokee swamp, and embraces mainly Charlton, Echols, and Clinch counties, and large portions of Ware, Pierce, and Wayne. It is considerably higher than the belt of the coast region that extends across other counties to the Savannah river, a dotted line through Glynn and Camden alone marking the line of separation between the two on the map. The country is very level open, and sparsely settled, and is covered with many swamps having a dense growth of titi, tupelo, and

black gums, sweet and loblolly bays, cassino, a short-leaf pine (*Pinus Elliotti*, or pitch pine of Mississippi), all interlocked and frequently tied together with bamboo briers, forming an impenetrable thicket. Long-leaf pine and cypress are the timber growth, and the open lands are often covered with a low and dense mass of saw-palmetto, gallberry bushes, and some wire-grass.

This region is about 125 feet above the sea, the descent being very rapid on the east from Okefenokee swamp to Traders' Hill, at the head of tide-water on Saint Mary's river. Thence there is a level second terrace to the edge of the savanna lands, 15 miles east of Colerain. This terrace is covered in places with deep, white sands, and is very similar to the third or Okefenokee upland.

In the entire section but little cotton is produced. The lands are sandy, though firm, and the roots of the saw-palmetto (*Sabal serrulata*) not only make travel disagreeable, almost forbidding the use of four-wheel vehicles, but give trouble in farming operations. The lands wear out rapidly, and have not as yet been renovated with fertilizers, new and fresh tracts being inclosed and cultivated. In the swamps the white sandy bottoms are covered with a muck several inches deep, while streams of dark and even black water flow sluggishly among the roots and cypress knees and across open spaces.

The creek bottom lands and hummocks of this pine-flat region are not very wide, and have a dark loam soil from 8 to 12 inches deep, with a clayey subsoil underlaid by a blue clay stratum. This latter is found also in wells on the uplands north of Homerville, Clinch county, at a depth of 9 feet from the surface. These lands, while considered the best for cotton, have but a small area devoted to that crop. It is claimed that its late planting, and consequent late maturity, makes it liable to be killed by early frosts. The growth of these hummock lands is chiefly oak, black gum, maple, and tupelo-gum, cypress, etc. The soil is said to be late, cold, and ill drained.

Okefenokee swamp.—This swamp has a width of 30 and a length of 40 miles, covering an area of about 500,000 acres. It is in reality an *upland swamp*, having an altitude of 120 feet above tide-water on the Saint Mary's river, 4 miles distant. A sand ridge (part of the water-divide of the state) 30 feet above the swamp extends along its eastern border to the south, becoming lower as it reaches the southern horseshoe bend in the Saint Mary's river. The swamp is highest on the northeast, and falls irregularly to the south and southwest from 126½ to 111½ feet at Ellicott's mound and on the southwestern corner.

The eastern part, 12 miles in width, is an open "prairie" or marsh, largely covered with water, in which are long rushes and water-lilies. Under its surface is a dense body of moss from 4 to 6 feet thick, the great mass of which is decayed, forming muck and peat. It is so dense that it will readily bear up a man's weight, merely sinking a little and rising for many feet around; hence the name Okefenokee—"trembling earth." Small islands, covered by clumps of cypress, bay, and cassino, frequently occur. The western part of the swamp is mostly covered by cypress trees and a dense growth similar to that of the small swamps outside, so tied together by bamboo briers and vines as to be impenetrable except by slow and tedious cutting away with bush knives. Small open marshes, and also a number of large islands, are found throughout this region. These islands are quite level, but are slightly elevated above the swamp lands, and have a sandy soil, with an open timber growth of long-leaf pine and a very low undergrowth of saw-palmetto, and are similar in every respect to the mainland. Their dimensions are 3 or 4 miles by from 1 to 2, and they are bordered by a low hummock land, on which there is a growth of magnolia, oak, etc. Hunters find deer and bear on these islands. The soil or bottom of the swamp proper seems to be but little else than white sand.

COAST REGION.

The coast region embraces savannas, live-oak lands, and islands, covering in all about 2,045 square miles.

SAVANNAS.—The region properly designated "*savannas*" occupies a belt of country from 10 to 15 miles wide between the pine barrens and wire-grass region on one side and the coast live-oak lands on the other, extends from the Savannah to the Saint Mary's river, and embraces nearly all of the counties of Chatham, Bryan, Glynn, and Camden, and large portions of Liberty and McIntosh. The surface of the country is very level and 10 or 15 feet above tide-water, and comprises what is known as the first terrace. Its northwestern limit is the bluff of the second or wire-grass terrace, passing through the lower part of Effingham (20 miles north of Savannah) into Bryan, where it is 50 feet high. Southward through Liberty county this bluff forms "the gravel hill" south of Hinesville, which has an elevation of from 15 to 30 feet above the sea; deep sands are found here. Thence the limit extends through McIntosh county to Waynesville, and, on the eastern side of the Satilla river, into and across Camden county at a distance of about 15 miles east of Colerain. At this last point the rise is about 25 feet. Within this region, adjoining the marsh lands, there is a belt of live-oak land having a width of several miles which properly belongs to the savannas. This region along the first or lower terrace is noted for its beautiful meadow or savanna lands, which are broad, flat, and open plains, having no growth other than sparse and tall long-leaf pine and a thick undergrowth of saw-palmetto, with here and there bunches of wire-grass that has found its way down from the upper terrace. In the spring and early summer months these plains are covered with a dense growth of flowers, which gives to them an enchanting appearance. The savannas at one time covered a large part of these counties, but the custom of burning off the lands to cause a growth of young grass for grazing purposes has also produced a scrub undergrowth of trees and bushes. The soils and subsoils outside of the live-oak lands are sandy and not much under cultivation. The streams are dark and sluggish.

LIVE-OAK AND COAST LANDS.—Along the coast (as well as occupying the islands) from the Savannah river to Saint Mary's river there is an irregular and interrupted belt of yellow or mulatto sandy lands about 10 miles wide, whose characteristic feature is the growth of very large live-oak trees. From their widely-spreading branches there hangs a very great profusion of "long moss" (*Tillandsia usneoides*), its long gray streamers reaching often as much as 10 or 15 feet toward the ground. Associated with the live-oak there is a growth of red and water oaks, hickory, chincapin, pine, red cedar, sweet gum, cabbage palmetto (*Sabal palmetto*), sassafras, and a tall variety of blue palmetto (*Chamærops hystrix*). There are properly three divisions of this live-oak belt, viz, *upland* or *ridge*, *middle*, and *lower bottom* lands, each comprising about one-third of the area. The first has sandy soils and subsoils, which are not considered as remunerative. The bottoms, on the other hand, are very rich, and have a dark soil underlaid by a blue clay.

These lands are well adapted to sea-island cotton, though but little attention is given to its cultivation. The yield is about 400 pounds of seed-cotton per acre.

Analyses of a representative soil and its subsoil of the live-oak lands are given below. The samples were taken by J. A. M. King, of Dorchester.

No. 511. *Soil* from near Sunbury, Liberty county, taken 6 inches deep. Growth, live oak.

No. 512. *Subsoil* of the above, taken from 6 to 12 inches deep.

Live-oak land, Liberty county.

	Soil.	Subsoil.
	No. 511.	No. 512.
Insoluble matter	93. 229	95. 355
Soluble silica	0. 303 } 93. 532	0. 674 } 96. 029
Potash	0. 062	0. 136
Soda	0. 153	0. 070
Lime	0. 106	0. 039
Magnesia	0. 178	0. 136
Brown oxide of manganese	0. 039	0. 015
Peroxide of iron	0. 285	0. 429
Alumina	0. 619	0. 742
Phosphoric acid	0. 067	0. 036
Sulphuric acid	0. 180	0. 141
Water and organic matter	4. 869	2. 509
Total	100. 090	100. 282
Humus	3. 776	.....
Available inorganic	0. 312	.....
Hygroscopic moisture	3. 210	2. 419
absorbed at	14. 5 C.°	14. 5 C.°

In view of the small amount of potash and phosphoric acid in this soil, its richness is no doubt due to the large percentage of humus and the fair quantity of lime, which renders available the phosphoric acid for plant-food. The subsoil does not come up to its assistance as these under-strata usually do, but is even more sandy and more deficient in plant-food than the soil, except that it has twice the percentage of potash, even then too small.

Mr. King thus describes these live-oak lands:

They vary in quality from heavy bottom to light sandy, and may be classed as upper, middle, and lower bottom lands, each covering one-third of the entire width. The soil of the bottom live-oak lands is dark and mucky, the upper belt having a blue-clay subsoil, the middle belt a dark sandy subsoil, while on the coast or lower belt the subsoil is a white sand.

The ridge live-oak lands are confined to the coast belt and the islands. The soil is sandy, either light or gray colored, with white sandy subsoils. The ridges are in reality but a huge ocean sand-bank covered with live oak and saw-palmetto, a few water oaks, and an occasional pine. These oaks on Black Beards' island are mostly stunted in growth, and on the sea side look like a closely trimmed hedge. Such lands would not remunerate cultivation, while the inland live-oak bottoms were considered the richest lands of the county. In the blue clay underlying these lands have been found well-preserved stalks and leaves of marsh grass (*Uniola*).

The live oaks of the region attain a great size, their lateral limbs often extending as much as 50 feet from the trunk. Long moss hangs in greatest profusion from the limbs, and wild grape-vines, measuring as much as 37 inches in circumference at the ground or 27 inches at a height of 7 feet, are found entwined among them.

The live-oak bottoms were mostly cleared and planted two or three generations ago.

THE COAST TIDE SWAMP LAND.—This occupies a narrow belt, not continuous along the Atlantic coast, but bordering on the various inlets and streams to the limits of tide-water. In White's *Statistics of Georgia* appears the following:

On the Savannah river the bodies of tide swamp land are extensive, and are cultivated upward of 20 miles from the brackish marsh up the river. On the Altamaha these lands equal in width those of the Savannah river, but from the marshes upward their extent does not exceed 16 miles, where the freshets forbid their being of any value except for timber. The soil has more of decayed vegetable mold than the land of the Savannah river, and is more easily cultivated. The tide lands of the Ogeechee extend from the marshes about 10 miles. Those of the Satilla, not as broad as those mentioned above, extend from the marshes 20 miles up the river, and are not liable to freshets.

On the Saint Mary's the swamp lands on the Georgia side extend only to the foot of the second terrace, some 15 miles east of Colerain, though tide-water reaches Traders' Hill. These are the rice lands of the state, being now almost exclusively devoted to its cultivation, though other crops do well. Black seed or Florida sea-island cotton was once one of the principal crops of these low swamp lands.

The soil of the swamp lands along the streams and inland is ash-colored and clayey, from 1 foot to 6 feet deep to a blue clay stratum. The growth is cypress, water oak, gum, ash, maple, beech, and saw-palmetto.

An analysis of a sample of this *soil*, No. 513, taken near Savannah, Chatham county, gave the following results:

Rice or swamp land, Chatham county.

	No. 513.
Insoluble matter	63.444 } 74.769
Soluble silica	11.325 }
Potash	0.242
Soda	0.079
Lime	0.387
Magnesia	0.508
Brown oxide of manganese	0.052
Peroxide of iron	3.894
Alumina	13.454
Phosphoric acid	0.071
Sulphuric acid	0.055
Water and organic matter	6.843
Total	100.354
Hygroscopic moisture	10.720
absorbed at	13 C.°

The percentage of phosphoric acid in this soil is very small, the potash respectable. The high lime percentage makes it thrifty by acting on the former; and as long as it holds out the soil will be good, especially with continued overflow.

MARSH LAND.—There is very little of what may be properly termed sea marsh along the Georgia coast. Very small areas are found at the mouths of some of the rivers.

THE SEA ISLANDS.—Along the coast there lies from one end to the other a perfect net-work of islands, large and small, having a rolling surface, not exceeding 15 feet above tide. Their united areas amount to about 560 square miles. The growth is live oak, cedars, pines, and saw-palmetto, with some magnolia, gum, etc. The soil is usually sandy and well adapted to the production of sea-island cotton, corn, and sweet potatoes. Lemons, figs, pomegranates, olives, oranges, and lemons grow finely. The cultivation of the sea-island cotton has been nearly abandoned since 1861.

The changes made in machinery for the manufacture of coarser staples when sea-island cotton could not be obtained (1861–'65) are said to have been its death blow.

The cultivation of upland cotton (short staple) is now receiving more and more attention since the introduction of commercial fertilizers. Of sea-island cotton these soils formerly yielded from 400 to 500 pounds per acre in the seed when fresh and 300 pounds after the fourth year.

REMARKS ON COTTON PRODUCTION IN GEORGIA.

EARLY HISTORY.—But little data are at hand concerning the early history of cotton production in the state. Its culture seems to have been begun on a very small scale in 1735, or about the same time as in South Carolina, seed having in the previous year been sent from England. In 1791 the yield was estimated at 500,000 pounds, equal to 1,250 bales of 400 pounds each. The sea-island variety, or long staple, is said to have been introduced in 1786. The *New York Commercial Bulletin* gives the following copy of a bill of lading, bearing date of July 20, 1751, now in possession of a prominent cotton commission merchant of New York:

Shipped by the grace of God, in good order and well conditioned, by Henry Hansen, in and upon the good Snow called the "Mary", whereof is master under God, for this present voyage, Barnaby Badgers, and now riding at anchor in the Harbour of New York, and, by God's grace, bound for London—To say—Eighteen Bales of Cotton Wool, being marked and numbered as in the margin; and are to be delivered in the like good order and well-conditioned at the aforesaid port of London (the Danger of the Sea only excepted) unto Messrs. Horke and Champion, or to their Assigns, he or they paying Freight for the said Goods three farthings p. pound, with Primage and Average accustomed. In witness whereof, the Master or Purser of the said Snow hath affirmed to three bills of Lading, all of Tenor and Date; the one of which three bills being accomplished, the other two to stand void. And so God send the good Snow to her desired Port in safety. Amen. Dated in New York, July 20th, 1751.

(Signed,) BERNARD BADGERS.

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In the margin of said document are the following references:

5 Bales marked III No. 105; 13 Bales marked II No. 1@13.

On the back of the well-worn frame which helps preserve the curious document is an extract of a letter from the secretary of the trustees for establishing the colony of Georgia. The following is an exact copy, and was addressed to the president of the "colony":

GEORGIA OFFICE (LONDON), *July* 7, 1749.

* * * * * * *

You say, sir, likewise in your letter, that the people of Vernonburgh and Acton are giving visible appearances of reviving their industry; that they are propagating large quantities of flax and cotton, and are provided with weavers, who have already wove several large pieces of cloth of an useful sort, whereof they sold divers and some they made use of in their own families. The account of their industry is highly satisfactory to the trustees; but as to manufacturing the produces they raise, they must expect no encouragement from the trustees, for setting up manufactures which may interfere with those in England might occasion complaints here, for which reason you must, as they will, always discountenance them; and it will be necessary for you to direct the industry of those people into a way which might be more beneficial to themselves and would prove satisfactory to the trustees and the public; that is to show them what advantages they will reap from the produce of silk, which they will receive immediate payment for, and that this will not interfere with or prevent their raising flax or cotton or any other produces for exportation unmanufactured.

This letter shows that cotton was raised and manufactured in the neighborhood of Savannah as early as the year 1748 in sufficient quantity to be the subject of official notice. It should be said that the term "Snow", mentioned in the bill of lading, was the name then given to a bark.

COTTON PRODUCTION IN 1880.—Georgia is now one of the great cotton-producing states of the Union, ranking first in the acreage devoted to that crop (2,617,138) and second in the number of bales produced (814,441), the state of Mississippi being first. Cotton is the chief crop of the state, its acreage being a little more than 34 per cent. of all the lands under cultivation (see Table II of leading crops) and averaging 44.4 acres per square mile for the state at large. The acreage of corn is 78,405 acres less than that of cotton. The great bulk of the crop is produced in the central belt of counties from South Carolina to Alabama, and but two counties in the entire state report no production at all, viz, Fannin and Towns, in the Blue Ridge region, where cotton is grown mostly in patches for home use, much of it failing to mature before early frosts unless hastened by the application of fertilizers. A reference to the map showing the relation between cotton acreage and the total area will give a fair idea of the varying degrees of intensity and the several belts of each, represented by different tints in color. The greatest intensity of cotton acreage (20 per cent. of total area) is shown, by the deepest shades, to occupy areas in the western part of the state, in the counties of Troup, Clayton, Spalding, Pike, and Houston. A large region of the next degree, from 15 to 20 per cent., also lies to the westward, chiefly in the metamorphic lands south and southwest of Atlanta, and to the eastward; also in the red lands of Lee and Dougherty, in the long-leaf pine region, and along the Chattahoochee river.

Altogether, it will be seen that the intensity of cotton acreage increases westward from the South Carolina line and diminishes toward the north and south, the central belt of intense acreage widening to the westward and reaching southwestward nearly to the Florida line, being cut in two by the belt of sand-hills along the lower edge of the metamorphic region; and that regions of almost no cotton production lie along the Atlantic coast of the southeast, the Blue Ridge mountain region of the northeast, and the extreme northwestern corner, or the Sand and Lookout mountain region, of the state.

TABLE III.—POPULATION AND COTTON PRODUCTION IN EACH AGRICULTURAL REGION OF THE STATE.

Agricultural region.	Area.	POPULATION.			COTTON PRODUCTION.									
		Total.	White.	Colored.	Acres.	Bales.	Average per acre.				Total in tons.		Percentage of the state's total production.	Average cotton acreage per square mile.
							Fraction of bale, 475 lbs.	Seed-cotton.	Lint.	Seed.	Lint.	Seed.		
	Sq. mls.							*Lbs.*	*Lbs.*	*Lbs.*				
Northwest Georgia	3,660	116,918	86,798	30,120	107,133	46,019	0.44	621	207	414	11,072	22,144	5.72	29.3
Blue Ridge	3,060	63,169	59,592	3,577	6,837	2,409	0.35	501	167	334	572	1,144	0.30	2.2
Middle Georgia	18,110	748,151	393,781	354,370	1,363,539	449,611	0.33	471	157	314	106,830	213,660	55.23	75.3
Central cotton belt	10,570	320,493	122,002	198,491	818,898	231,411	0.28	402	134	268	54,960	109,920	28.41	77.5
Lime-sink and southern oak and hickory uplands.	7,360	121,847	59,374	62,473	253,566	62,149	0.25	348	116	232	14,760	29,520	7.63	34.4
Pine barrens	10,140	79,076	55,922	23,154	57,443	19,350	0.34	480	160	320	4,596	9,192	2.38	5.7
Coast and pine flats	6,080	92,526	39,437	53,089	9,722	2,692	0.28	396	132	264	639	1,278	0.33	1.6
Total	58,980	1,542,180	816,906	725,274	2,617,138	814,441	0.31	444	148	296	193,429	386,858	100.00	44.4

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MAP OF GEORGIA

SHOWING
IN THE DIFFERENT SECTIONS OF THE STATE
THE RELATION BETWEEN THE
AREA CULTIVATED IN COTTON
AND THE TOTAL AREA
BY

R. H. LOUGHRIDGE, Ph.D.
SPECIAL AGENT, 10TH CENSUS

1880.

LEGEND.

Percentage of total area planted in Cotton in 1880.

I	0 to 0.1 per cent.
II	0.1 to 1 " "
III	1 to 5 " "
IV	5 to 10 " "
V	10 to 15 " "
VI	15 to 20 " "
VII	20 per cent and above.

Scale
25 0 25 50 75 100 MILES.

The rich valleys of Floyd, Polk, and Bartow give a vigorous growth to the stalk, fertilizers hasten maturity of the cotton, and the season is sufficiently mild and long to permit the gathering of a very good crop. The average production for the region is four-tenths of a bale per inhabitant.

The altitude of the *Blue Ridge region* is too great and the season too short to make the production of cotton as profitable as in other parts of the state. Up to the present time the lack of sufficient transportation facilities to market also causes the farmers of the region to take but little interest in cotton production, and we therefore find an average of but 2.2 acres of cotton per square mile, the counties of Fannin and Towns reporting none at all. The region produces but 0.30 per cent. of the total yield of the state.

The *coast and pine flats* also produce very little cotton, the average of that crop being but 1.6 acres per square mile, and the total yield but 0.33 per cent. of the state's production. The region is well adapted to the sea-island or long staple variety.

PRODUCTIVENESS OR PRODUCT PER ACRE.—The general average yield for the state is nearly one-third of a bale per acre, and this, too, is the general result anticipated by the farmers themselves when they prepare their lands for the crop. This yield would be very greatly increased by the judicious use of fertilizers, as is shown in the many experiments made under the direction of the Georgia department of agriculture and by individual persons.

A comparison of the scale of productiveness in the counties of the eastern, middle, and western parts of the state (excepting all that part north of the Atlanta parallel, which is newer in cotton culture) shows that those having the highest product per acre lie chiefly on the east of the Ocmulgee and Altamaha rivers, their averages ranging from 0.30 to 0.45, while on the west to the Alabama line they range from 0.30 to 0.17 of a bale. Comparing the averages of the two extreme tiers of counties, we find those on the Savannah river from the coast to the Blue Ridge to average a little over one-third (0.34) of a bale per acre, and those on the Chattahoochee from the Florida line to the northwestern region to average but little over a fourth (0.28) of a bale. The counties of Haralson and Carroll, in this latter list, have high averages, which raise the total above that which it would otherwise be.

In view of the fact that there is a larger proportion of the better class of oak and hickory uplands and less of wire-grass lands on the west, the results show a better system of culture on the east, with perhaps a more general use of fertilizers. The great bulk of commercial fertilizers enters the state from the east and from the coast ports, and would naturally be brought into more general use there than in other parts of the state.

The culture of cotton in the northern counties of the state is a comparatively new industry, and the lands are not so much worn as southward. We therefore find the maximum of natural productiveness per acre in those counties north and east of Atlanta, with a gradually descending scale as we go south.

Comparison by regions.—The *northwestern region* not only ranks highest in product per acre (over four-tenths of a bale), but embraces the "banner" county of the state, Polk, whose average is about one-half a bale per acre. The freshness of the lands, still further enriched by fertilizers, has tended to produce this result, which would be much greater but for the fact that early fall frosts cut off a large part of the maturing crop.

The product per acre in the *metamorphic* reaches one-third of a bale, while that of the *central belt* is far below it. In view of the immense amount of commercial fertilizers used in the state, these low per cents are surprising. Even the "poor piny woods" are made to surpass the lands of the central belt, and that, too, when marls and limestones underlie the latter so abundantly. The *lime-sink region* and *southern oak and hickory uplands*, because of the small area comprised in the latter, are classed as one. The average productiveness per acre of the two is one-fourth of a bale, or about what the lands would produce without fertilizers. The region ranks lowest of all in this respect, a fact coincident with that already mentioned, viz, a low scale of productiveness per acre in nearly all of the counties of the western side of the state.

The *pine barrens*, which heretofore have been almost exclusively devoted to stock-grazing and the turpentine and lumber industries, are being settled by people who see that with the aid of fertilizers the poor sandy lands of the region can be made to produce cotton abundantly. The result is seen in a product per acre somewhat greater than that of the oak and hickory clay lands of even the more favored metamorphic region. In contrast with the southwestern region, this belongs to the *eastern* side of the state, where the products per acre are highest, owing, no doubt, to a more judicious and abundant use of fertilizers. The cotton acreage of the region is comparatively small, and only the best lands are devoted to this crop.

The *coast counties* are low in the scale of productiveness, and cotton is considered rather a secondary crop in that region. The variety to which these lands are specially adapted (sea island) is not in great demand, and its culture is said to have decreased since 1870. Attention is now being turned to the culture of the short staple.

In the tables which give the amounts of seed-cotton, lint, and cotton-seed produced per acre in each region the estimate is based on 475 pounds as the average bale and the generally accepted rule that seed-cotton will "third itself" in lint. This weight of the bale is the average reported for the season from Savannah and Atlanta, an increase over that of 1870, due probably to the more general use of improved presses having a greater power and capacity for heavier bales, and also because transportation charges are *per bale*, irrespective of actual weight.

"BANNER COUNTIES."—For the state with regard to total number of bales—Burke, 29,172 bales; with regard to average product per acre—Polk, 690 pounds of seed-cotton; with regard to percentage of tilled lands in cotton—

Troup, 51.29; with regard to average cotton acreage per square mile—Troup, 153.9 acres; with regard to average bales per square mile—Clayton, 47.2 bales. Twenty-three counties produced more than 10,000 bales each, and of these nine produced about 15,000 each.

In the entire state Burke county, of the central cotton belt, is the "banner" county as regards number of bales produced in 1879, Washington being next. In "product per acre", however, it falls far below, to the fifty-third place, Polk county, on the northwest, being first. In its own region it ranks third in product per acre.

In the metamorphic region Troup county produces the largest number of bales, but its product per acre is low (not three-tenths of a bale), there being forty-six counties in the region and ninety-six in the state having larger percentages.

Cobb county ranks first in its own region in product per acre, producing nearly one-half a bale per acre, there being but one county in the state (Polk) with a higher percentage.

Echols and Bryan counties are the two banner counties of the eleven coast and pine flats counties, the latter ranking highest in product per acre in its region (four-tenths of a bale). Column 13 shows that there are in the state twenty-one counties above it in this regard. Its acreage and its number of bales are small.

In the central cotton belt Richmond county stands first in product per acre, even above Burke, the "banner" county for total production in the state, owing probably to the large cultivation of valley lands of the Savannah river, and to the fact that within its limits (in the city of Augusta) there are fertilizer manufactories, from which supplies can be obtained in abundance. The greater part of the county is included in the sand-hills region, comprising the poorest lands of the central belt.

In the lime-sink and southern yellow-loam regions Dooly for total production and Screven for product per acre rank first, the latter being also above that of any of the counties of the central belt; a fact to be accounted for only in the improved methods of culture, for the lands of the county, except along the river and on the north, are mostly sandy with sandy subsoils, and are much inferior to those of Brooks, Jefferson, and Washington.

It will be seen also, by reference to the tables placed at the beginning of this report, that there are in the state twenty-two counties with average products of 0.40 of a bale per acre, and thirty having over 0.36; also that there are sixty-three counties whose average is at least 0.33 of a bale, each of the rest producing less.

Mr. McCutchen says of the region of northwest Georgia:

> The production of cotton as a staple crop in this part of the state until within the last few years has been confined mostly to the counties of Polk, Floyd, Chattooga, Bartow, Gordon, and the southeastern part of Walker. Since the general use of fertilizers, there can be said to be no limit to its area within this state except that due to the altitude of high mountain ranges.
>
> There is a marked increase in cotton production in all of these counties in the last ten years. Of this the southern counties show the largest amount of increase, though the largest percentage of increase is found to be in some of the northern counties, where comparatively little is grown. From a comparison of the returns of the district enumerators it appears that lands on which cotton has not been grown until recently have given sometimes even a better average yield per acre than that of other localities where cotton has long been grown with success and where the lands are thought to be better adapted to its growth. Two causes may combine to produce this result: (1) The partial exhaustion for this crop of the lands on which it has long been grown, and (2) the greater dependence on the use of fertilizers on some lands not naturally so well suited to this crop.

LABORERS.—Negroes comprise the majority of laborers throughout the state, though in the extreme northern counties there are very few of this class, for they prefer the warmer climate and towns of middle and southern Georgia. While a large majority of them live "from hand to mouth", many have been provident and have accumulated property both in the country and in towns. This fact, as well as their mania for living around towns and cities, is shown in the report of the comptroller-general for 1880, from which the following summary is taken:

Value of land owned by them (586,664 acres)	$1,522,173
Value of town property owned by them	1,201,992
Value of stock of all kinds owned by them	2,054,787
Value of other property	985,341
Making a total of	5,764,293

METHODS OF CULTIVATION.—A summary of the answers in Part III, showing the general method of the planting and cultivation of cotton, may be thus given: The preparation that precedes planting consists usually in first "laying off" the rows by deep furrows 3 or 4 feet apart and then "bedding up" over these with turn-plows. By some farmers this "bedding up" is not practiced, but planting is done in the furrows on level land. When fertilizers are used, they are either placed in the furrows and the land bedded over them, or the top of the bed is opened with two furrows, one in the other, into one of which from 100 to 200 pounds of the fertilizer is placed by means of a tin funneled tube 3 or 4 feet long, and into the other the cotton-seed is distributed either by hand or by cotton-seed planters and covered usually with a plow or often with a board drawn on its edge over the rows. The seed is either planted directly or is first soaked or rolled in fertilizers, which is said to cause an earlier appearance of the plant.

Each farmer has his favorite among the many varieties of seed, which, either because of the long limbs of the plant (producing more to the stalk) or its short limbs (allowing the stalks to be nearer together), or of some other feature, apparently causes a productiveness greater than that of any other variety. Some planters try to improve

well-known varieties by various means, and, while successful in part, the result frequently is but different names for the same seed. Although the careful selection from the crop of cotton-seed for planting is of as great importance as with other seed, it seems to be but little thought of by many planters, who, upon the principle that "cotton-seed is cotton-seed", simply take their seed from the gin-house pile. Two or three bushels are usually required per acre, except when the seed is carefully selected, when 1 or 1½ bushels are used.

Planting usually occurs in April, or, if the season is unfavorable, in May. The seed comes up in a week or ten days, and is then "barred off" or the dirt is thrown from the row to the middle with a small or narrow plow, the plant being protected by a board or scrape, attached to the plow, with its end turned up to run between the plow and the plant. The crop is now "chopped out" with hoes, cutting away 8 or 10 inches of the young plants and leaving a bunch in each hill, to be thinned out subsequently to two plants per hill. By this time the plant is 8 or 10 inches high and several leaves have appeared. The dirt is then thrown back from the middle of the row by means of a sweep. Hoeing between the hills is kept up continuously, and this shallow cultivation is continued until near the picking season, the crop being thus worked over from three to five times. In about two months the first blooms appear, at first white in color, then changing to purple and red on the second day. The bolls begin to open in about six weeks after the blooms appear, and picking commences in a few days, or as soon as it will pay to pick. When the bolls burst the cotton opens out in large balls or locks, soon making the fields perfectly white. The boll soon becomes brown and begins to shrink up, and the cotton, thus loosened, hangs from it, and is liable to be blown to the ground by the wind, or after a time falls of its own accord. The demand for pickers is therefore great, and the price paid is usually from 50 to 75 cents per 100 pounds of seed-cotton, the pickers furnishing their own subsistence. Weighings are made every night, and the laborer is either paid then or is given credit. The cotton is stored in some safe place or in the gin-house until it can be ginned and baled. Some few farmers sell the cotton while in the seed, but most of them either gin it themselves or have it ginned by others, paying a certain toll. Picking continues until but little cotton remains in the field or until the winter rains begin, the crop being picked over once in each month, or oftener if possible. The bolls continue to ripen and open until killed by frost, which occurs usually about the last of October, the picking continuing until near Christmas.

Ropes have gone entirely out of use as a means of baling cotton and hoop-iron has taken their place. The tie is usually an inch in width, and, after being passed around the bale while the latter is under heavy pressure, the ends are fastened together by means of a small cast-iron "fastening". These fastenings comprise a number of kinds, the points most to be desired, next to strength, being the readiness and quickness with which they may be adjusted and security against becoming loosened or broken in the rough handling to which the bales are afterward subjected. There are four classes into which they may be grouped: (1) The "arrow", in which the ends of the tie are attached by simple loops, each being bent under. (2) The buckle, as the "Beard", being the fastening attached (by the manufacturer) to one end of the tie and made to slip through the perforations of the other end. (3) The hook fastening, which is fastened to one end of the tie and simply hooks into the perforations of the other. (4) The "Delta", also fastened to one end of the tie, and made to clasp the loop of the other by simply closing the two arms of the fastening. The "arrow" fastening is most generally in use.

The cost of cotton production, exclusive of commissions, freights, etc., is variously estimated at from 7 to 10 cents per pound, the general average, as well as a majority of estimates, being 8 cents. This embraces the cost of commercial fertilizers, which are usually applied directly to the soil and without regard to its actual necessities. With the raising of home supplies and the more careful attention to cultural details, as embodied in what is known as the "intensive system", there is no doubt but that the cost would be greatly lessened and the net profits of cotton production correspondingly increased, in addition to the many other advantages to the farm and home that would be derived from the system. Mr. Furman's estimate by his method is 4½ cents per pound (see below).

INTENSIVE CULTURE.—Within the past few years the subject of an intensive system of culture has begun to attract much notice, chiefly through the successful efforts of a few intelligent farmers, who, by scientific methods of treatment, have produced enormous yields of cotton from fields accustomed to give an average of but about 500 pounds, and even less, of seed-cotton per acre.

Hon. F. C. Furman, near Milledgeville, Baldwin county, is most prominent because of his extraordinary success in producing 75 bales of cotton and 500 bushels of oats from 65 acres of old land that had previously yielded but 8 bales of cotton and was considered worthless. That this was no spasmodic result, but was attained by careful and intelligent culture, based upon a knowledge of the *wants of the soil and of the plant*, is shown in the following method, which, by request, he has furnished:

In 1878 I took 65 acres of land, the original growth of which was scrub oak and pine. It lies well, is slightly rolling, and was cleared near 30 years ago. The soil is light sand with a firm red-clay subsoil within 5 or 10 inches of the surface, and was worn out and considered worthless years ago. This piece of land, planted in cotton and cultivated carefully without manure, yielded me the first year 8 bales; second year, with 500 pounds of compost per acre, the yield was 12 bales; third year, with 1,000 pounds of compost per acre, the yield was 23 bales; fourth year, with 2,000 pounds of compost per acre, the yield was 47 bales. This year (1882) I used 4,000 pounds of compost per acre and have gathered 75 bales. From 5 acres of this land I this year harvested 500 bushels of oats. I then planted it in cotton (June 7), and the yield was from 1½ to 2 bales per acre. My estimate of the cost of production this year is 4½ cents per pound.

Up to this time I have made no great departure from the Dickson system of cultivation and preparation, have never subsoiled, and only break my land in bedding, plant very late, never till after May 1, manure in the drill, opening deep and wide, listing in the manure and letting it stand until ready to plant, then throw two furrows on the list and plant with a Dowlaw planter, breaking out the middles and finishing the bed after the cotton is in the ground, thus giving a porous bed for the plant and killing the first crop of grass at the same time; cultivate with a sweep, and let the cultivation be as shallow as possible. I change the drills 12 inches every year, so as to enable me in four years to manure across my land with 4-foot rows.

The true secret of my success lies in the character of my compost. I insist upon furnishing each crop with a manure that contains every element necessary to that crop (combined in the proportions in which the crop requires them). In order to do this, accurate knowledge of the chemical composition of the crop (stalk, leaf, and fruit) is essential. For cotton, then, my aim was to make a compost that would contain the elements that form it, viz, phosphoric acid, potash, soda, humus, lime, silica, and nitrogen, and in the right proportions. This compost is made with 30 bushels of cotton-seed, 30 bushels of stable manure or well-rotted leaves or organic matter, 400 pounds of acid phosphate, and 200 pounds of kainit.

In this mixture the kainit is indispensable. It furnishes potash, lime, magnesia, soda, and a substance called "bittern", and, combined with humus, is a specific against rust in cotton. After manuring in the drill for 4 years and filling the ground with humus we come to a point where ideal cotton culture can begin. Now we begin to manure broadcast, turning it in flush, harrowing the ground, laying it off on a level in rows 4 by 4 feet, and planting cotton at the intersection of each furrow. In this system we dispense with the hoe, the most deadly enemy the cotton-plant has to encounter, and use the plow altogether, plowing both ways, and thinning by hand to a stand of two stalks per hill. Upon this system of culture, properly carried out, I believe that an average production of 3 bales of cotton per acre is possible.

TRANSPORTATION.—The principal cotton markets in the state are Savannah, Augusta, Atlanta, Macon, and Columbus. As a rule, farmers prefer to sell to local buyers at railroad stations, thus avoiding delay, trouble, and commission charges, which are found to counterbalance any additional advantages that might arise with small shipments to great markets.

The owners of very large farms usually secure the services of commission merchants, to whom the factories send their orders. Some of the latter, however, have their agents in the various portions of the state, who buy directly from the planters, taking the cotton from the wagons at the depots.

The rates of transportation over the different routes vary according to the relation of competing lines. The rates were once fixed *per bale of any weight* above 300 pounds, and it was therefore to the advantage of the shipper that the weight of a bale should be as great as possible, limited, of course, by other expenses, such as the extra handling and drayage incident to such an increased weight.

These weights frequently reached 600 pounds, but 475 pounds was in 1879 the usual bale. The irregularity of charges made by the railroads caused such a feeling of dissatisfaction in the state that a railroad commission has been created by the legislature and a schedule of rates as uniform as possible has been adopted, not by the bale, as heretofore, but by the pound, and the tendency now is a reduction in the weight of the bale for greater convenience in handling. This commission has just been established, and this fact will explain the discrepancy between the answers of the various correspondents in the county descriptions, which were made at different times. The ordinary bales coming from the country presses are large and bulky, and take up so much unnecessary space that transportation companies now almost invariably have them reduced from 40 to 50 per cent. in size before shipment by means of steam hydraulic compresses. The pressure applied varies in the different presses, the highest being about 3,800 tons per bale. So perfect are the details of manipulation that from 100 to 150 bales per hour are passed through each press.

The cities of Augusta, Athens, Atlanta, Savannah, and Brunswick are supplied with these presses, all owned by private companies, the charges, which range from 25 to 60 cents per bale, being paid by the transportation companies. Savannah is the chief export town of the state.

FERTILIZERS.—Previous to the late civil war, when there was much land that had never been under tillage, planters gave but little attention to the restoration of old worn-out lands, or to the maintenance of fertility in those under cultivation. When crops became poor, new lands were cleared and cultivated, and tillage was shallow, subsoiling but little practiced, and fertilizers were almost unknown. With the abolition of slavery, and the consequent unreliability of labor and greater cost of production, came the question of obtaining the greatest results with the least labor and cost. Commercial fertilizers were introduced and found to be beneficial on some lands and not on others, and because of high prices were thought to be unprofitable by most farmers. Many inferior brands were also introduced, and finally the legislature, to protect the people against worthless fertilizers, required that none be offered for sale without having been analyzed and approved by the state department of agriculture. Inspectors were appointed at Savannah, Augusta, Atlanta, and other points, whose duties were to take average samples of every cargo or brand and transmit them to the department for analysis.

Every "ammoniated superphosphate" must have in its composition a minimum of 8 per cent. of available phosphoric acid and 2 per cent. of ammonia; every brand of "acid phosphate" or "dissolved bone" must have 10 per cent. of available phosphoric acid; and it was made the duty of the commissioner of agriculture to prohibit the sale of any fertilizer which was found not to meet these requirements. The cost of inspection and of analysis is covered by a fee of 50 cents for every ton inspected, and is paid by the manufacturer. The result of this rigid inspection law is a greatly increased nutritive value without additional cost per ton to the farmer.

PINE STRAW.—Another fertilizing element that could very profitably enter into compost heaps is the fallen long-leaf pine straw that usually covers the ground in southern Georgia. The following analysis and remarks are taken from the report on Mississippi by Professor Hilgard. The air-dried "straw", carefully freed from adhering impurities, yielded 2.5 per cent. of ash. The composition of the latter (calculated exclusive of about 6.5 per cent. of carbonic acid) was found to be as follows:

Ash of long-leaf pine straw.

	Ash.
Silica	65.242
Potash	5.530
Soda	0.410
Lime	13.860
Magnesia	5.208
Brown oxide of manganese	1.081
Peroxide of iron	0.141
Alumina	4.539
Phosphoric acid	1.154
Sulphuric acid	0.839
Potassium chloride	1.479
Total	100.089

[Notwithstanding the unusually low percentage of phosphoric acid shown by this analysis, the composition of this straw is such that about 1,400 pounds of it would amply replace the drain upon the soil caused by the growing of one bale of cotton lint, provided the seed and stalk be also returned.

In the sandy, unretentive soils of the region, however, the pine straw, when turned under by the plow directly, will sometimes not decay for one or two seasons, and thus renders the soil too open for cultivation in the interval. It should therefore be first used as a material for composting, whether with earth, muck, stable manure, or marls, bone meal, etc., as the case may be, and only applied to the land after it is decayed. This practice is already pursued in the older states with excellent results.

It is thus possible to concentrate the fertility of a large area of pine land upon a small portion kept in a high state of culture, instead of (as has heretofore been done) clearing laboriously large areas, whose profitable fertility lasts only a few years and then suddenly "gives out", in consequence, no doubt, of the exhaustion of the plant-food accumulated near the surface during many years by the decay of the pine leaves. Whether it will be best to apply this system to the production of cotton on these pine lands, or whether other branches of husbandry could, on the whole, be more profitably pursued, is a question that must be largely determined by local and commercial conditions. Since cotton, so long as the seed is regularly returned to the soil, is undoubtedly the least exhaustive crop known, its culture would seem to be specially adapted to lands of limited natural resources under an intelligent system of farming.—E. W. H[illegible]

GENERAL COMPARISON OF THE SOILS OF THE STATE.—In the northwest the broad valleys between the ranges of hills and mountains are covered with clay lands from the limestones, shales, and sandstones, and are the richest and most durable of the state. The lands of the adjoining metamorphic or mineral region, extending south to Columbus, Macon, and Augusta, are of rocks entirely different in structure, and composed of minerals which resist disintegration to a greater extent. The lands are therefore more sandy, less fertile, and differ in character almost every few feet.

The lands of the southern half of the state are still more sandy, but more uniform in physical constitution, having been more thoroughly intermixed throughout their several regions by the waters in which they were deposited or brought down from the hills of the "up country".

The lands of the several regions are above described under their respective heads.

Analyses of many of the soils of the state have been made in part under the auspices of the Georgia department of agriculture, but chiefly under that of the Census Office, and a table of the results will be found on page 64. The samples, except those from Polk, Walker, Screven, Telfair, and Liberty counties, were taken from the large collection made under the supervision of the state geological survey, and are probably fair averages of their class. It is a matter of regret that they were in most cases taken to so shallow a depth, the soil being taken to where the character and color changes to the subsoil, while no definite rule was observed with regard to securing a fair average of the subsoil to the depth reached by vegetation. Hence the differences shown in the composition between the surface soils and the subsoils are not as great as those which in practice influence vegetable growth.

The soils of northwestern Georgia, excepting that of Armuchee valley, show the presence of plant-food in percentages commensurate with the high fertility that they are reported to possess. The percentages of phosphoric acid and of potash are greater than in any other of the soils of the state thus far analyzed, and there is a sufficiency

of lime present to make them readily available to plants. The soil from Armuchee valley is evidently not a fair representative of the lands of that valley, the fertility of which is very great. Indeed, so completely have all of its arable lands been put into cultivation that a fair sample of virgin soil was scarcely obtainable.

In the metamorphic region, because of the greater differences in the nature of the rocks from which the soils are derived, a greater diversity of soil composition is to be expected, and this great diversity appears in the results of the analyses. The insoluble residues are naturally greater in the gray sandy and granitic lands than in the red lands, and range from 90 to 94 per cent. The portion of this soluble in carbonate of soda (soluble silica) is from 1 to 3 per cent. In the red lands the percentages of insoluble residue vary from 62 to 91, while the soluble silica reaches as high as 9 per cent., due largely to decomposition of clay by acid in the process of analysis.

The feldspar in the granitic lands would naturally give to those lands the highest percentages of potash, though in all the soils of the metamorphic the percentages of this element of fertility are comparatively low. The percentages of phosphoric acid are not high in any of these lands, but in most of them are extremely low; the highest are shown in the analyses of soils from Douglas and Cobb counties. In some of the counties the proportion of phosphoric acid in the soil is as low as 0.02 per cent., and shows conclusively the need of phosphate manures.

Lime is shown by these analyses to be especially needful in rendering available the little phosphoric acid that is present. In but few of the soils does this latter reach one-tenth of 1 per cent., the minimum which, with a large supply of lime, would be considered adequate.

The subsoils of this region are more clayey in character, and, as a rule, are richer than their soils. A few cases only occur in the table of analyses in which the reverse is true.

In the lands of the southern part of the state there is a general deficiency of lime, potash, and phosphoric acid even in the virgin soils. 329

Analyses of soils and subsoils of Georgia.

Number.	Name.	Locality.	County.	Vegetation	Depth.	Insoluble residue.	Silica, soluble in carbonate of soda.	Total insoluble residue and soluble silica.	Potash.	Soda.	Lime.	Magnesia.	Brown oxide of manganese.	Ferric oxide.	Alumina.	Phosphoric acid.	Sulphuric acid.	Volatile matter and water.	Total.	Hygroscopic moisture.	Temperature of absorption (C.°).	Analyst.
	NORTHWEST GEORGIA.				*Inches.*																	
505	Mulatto valley soil	Armuchee valley	Walker	Oak, hickory, and pine	6	89.680	1.713	91.393	0.178	0.065	0.047	0.031	0.041	1.750	2.677	0.188	0.041	2.980	99.391	4.336	14.0	J. B. Durrett.
506	Gray cherty ridge soil	La Fayette	do	Oak, hickory, poplar, chestnut, and pine.	6	81.470	7.456	88.926	0.422	0.277	0.197	0.878	0.178	1.989	3.050	0.411	0.193	4.405	100.926	6.312	13.0	Do.
517	Dark mulatto soil	Cedartown	Polk	Black, red, post oaks, hickory, a few short-leaf pines and black gums, with dogwood, walnut, and buckeye in the richer spots.	8	67.319	5.207	72.526	0.334	0.063	0.286	0.392	0.034	6.234	9.721	0.042	0.328	*10.015	99.975	9.768	16.0	G. E. Colby.
502	Mulatto soil	do	do		8	72.320	4.230	76.550	0.725	0.165	0.290	0.255	0.179	6.290	7.101	0.261	0.114	6.600	98.580	8.705	18.0	J. B. Durrett.
503	Red subsoil of No. 502	do	do		8–16	70.835	12.180	83.015	0.320	0.067	0.205	0.317	0.137	5.800	6.190	0.360	0.095	3.213	99.719	8.051	19.0	Do.
21	Red soil	Johnson's mill, Pine Log road.	Bartow	Hickory, white oak, pine	10	70.391	4.400	74.791	0.225	0.003	0.057	0.201	0.389	12.650	5.750	0.137	0.002	5.256	99.461	9.790	16.0	R. H. Loughridge.
66	Mulatto soil	Raccoon creek, Stilesboro'	do	Oak, pine, hickory	3	79.939	3.271	83.210	0.209	0.001	0.291	0.181	0.436	3.287	5.176	0.130	0.003	7.019	100.003	7.740	21.0	Do.
67	Mulatto subsoil	do	do	do	3–9	77.360	5.041	82.401	0.155	0.020	0.095	0.246	0.255	4.302	7.898	0.144	0.063	4.591	100.170	8.560	18.0	Do.
68	Mulatto soil (cultivated fifty years).	do	do	Cleared land	3	76.830	6.850	83.680	0.207	0.009	0.189	0.203	0.234	4.404	7.097	0.076	0.045	4.496	100.640	6.680	17.0	Do.
69	Mulatto subsoil of No. 68	do	do	do	3–9	70.230	9.970	80.200	0.337	Tr.	0.179	0.326	0.142	4.886	3.373	0.071	0.037	4.862	94.413	8.020	17.0	Do.
70	Dark bottom soil	Raccoon creek, Alabama road.	do	Ash, poplar, gum, elm	10	84.192	4.638	88.830	0.205	0.001	0.211	0.205	0.127	2.250	3.631	0.099	0.028	3.737	99.324	4.550	18.0	Do.
71	Subsoil of No. 70	do	do	do	10–15	82.050	6.870	88.920	0.212	0.002	0.126	0.255	0.058	3.568	3.800	0.147	0.013	2.561	99.662	4.550	17.0	Do.
74	Dark soil	Pumpkin-vine creek	do	do	15	83.110	3.890	87.000	0.160	0.021	0.264	0.509	0.067	3.146	3.896	0.242	0.055	4.212	99.572	4.170	18.0	Do.
518	Mulatto soil	Near Adairsville	do	Walnut, hickory, persimmon, post and black oak, and pine.	1	64.874	10.988	75.862	1.150	0.028	0.160	0.805	0.150	6.886	7.720	0.218	0.016	*6.681	99.676	8.410	17.0	Do.
11	Subsoil of No. 518	do	do	do	8–12	69.691	11.088	80.779	0.925	0.003	0.106	0.666	0.278	5.239	8.823	0.209	0.063	3.512	100.603	9.440	17.0	Do.
519	Mulatto soil (cultivated one hundred years).	do	do	do	5	.....	.....	79.711	0.503	0.092	0.282	0.476	0.178	13.409		0.140	0.035	*5.637	100.463	6.440	17.0	Do.
9	Subsoil of No. 519	do	do	do	5–19	68.105	10.674	78.779	0.706	0.028	0.161	0.447	0.373	4.571	10.784	0.252	0.037	4.595	100.733	7.840	20.0	Do.
	METAMORPHIC REGION.																					
	Granite lands.																					
288	Mulatto soil	1 mile from Jonesboro'	Clayton	Hickory, post oak, blackjack, and chestnut.	6	86.572	3.441	90.013	0.240	0.081	0.080	0.064	0.160	2.171	3.045	0.232	0.080	3.868	100.034	2.776	19.0	J. B. Durrett.
170	Ogeechee ridge soil	11½ miles northeast of Sparta.	Hancock	Red oak, hickory, and pine.	8	92.335	1.455	93.790	0.099	0.020	0.175	0.025	0.070	1.438	2.417	0.145	0.021	2.209	100.409	2.160	21.0	Do.
142	Gray sandy soil	Southwest of Lincoln	Lincoln	Red oak, post oak, pine, and hickory.	6	92.090	1.220	93.310	0.110	0.035	0.090	0.025	0.126	0.963	1.959	0.191	0.105	3.477	100.391	1.890	21.0	Do.
143	Subsoil of No. 142	do	do		6–12	91.810	1.190	93.000	0.154	0.024	0.062	0.058	0.048	1.715	3.653	0.105	0.030	1.482	100.331	1.560	20.0	Do.
	Gray sandy lands.																					
212	Gray soil	1 mile north of Clarksville	Habersham	Oaks, hickory, and pine	6	91.098	1.828	92.926	0.122	0.122	0.021	0.081	0.025	0.847	2.598	0.035	0.026	3.316	100.069	1.700	12.0	R. H. Loughridge.
213	Subsoil of No. 212	do	do		6–9	80.276	3.409	83.685	0.171	0.036	0.044	0.053	0.161	4.134	7.066	0.076	0.006	4.619	100.051	3.270	12.0	Do.
507	Gray soil	Dr. Janes, near Penfield	Greene	do	6	91.244	1.017	92.261	0.135	Tr.	0.026	0.089	0.022	1.320	3.305	0.116	0.020	2.416	99.710	2.300	16.0	Do.
508	Subsoil of No. 507	do	do		6–9	85.344	7.174	92.518	0.110	0.004	0.023	0.084	0.018	1.178	3.428	0.132	0.017	3.122	100.634	2.670	16.0	Do.
	Red and mulatto soils.																					
82	Hill land soil	Half a mile north of Pray's church.	Douglas	White oak and hickory	3	86.265	2.570	88.835	0.159	0.100	0.133	0.033	0.157	2.660	3.183	0.297	0.196	4.598	100.351	2.847	18.0	J. B. Durrett.
206	Red clay subsoil of No. 82	do	do		3–10	86.430	1.520	87.950	0.225	0.095	0.095	0.080	0.145	3.810	4.708	0.142	0.101	3.175	100.526	2.960	19.0	Do.

208	Deep red soil	Marietta	Cobb	Post, red oak, and hickory	8	60.370	2.000	62.370	0.186	0.119	0.070	0.065	0.196	9.705	18.006	0.204	0.285	8.953	100.210	8.479	13.0	Do.
390	Red soil	9 miles east of La Grange	Troup	Oak, hickory, ash, poplar, pine, chestnut, persimmon, and buckeye.	4	77.688	5.747	84.435	0.147	0.049	0.059	0.127	0.029	4.812	5.670	0.131	0.115	5.360	99.934	3.533	18.0	R. H. Loughridge
391	Red subsoil of No. 390	do	do		4–9	77.005	7.937	84.942	0.138	0.015	0.091	0.151	0.064	5.213	6.713	0.100	0.071	3.776	101.274	3.841	19.0	Do.
254	Red soil	Northeast corner of county	Monroe	Post and white oaks, chestnut and pine.	4	81.924	5.453	87.377	0.129	0.042	0.037	0.123	0.029	4.160	3.566	0.127	0.085	4.398	100.105	3.498	13.0	Do.
255	Red subsoil of No. 254	do	do		4–9	71.582	9.021	80.603	0.154	0.093	0.033	0.149	0.005	9.212	3.810	0.164	0.368	5.311	99.902	4.709	16.0	Do.
172	Sandy mulatto soil	5 miles north of Athens	Clarke	Red oak, hickory, and pine	12	88.440	3.175	91.615	0.153	0.071	0.060	0.111	0.060	2.214	4.272	0.105	0.050	1.938	100.649	2.039	18.0	J. B. Durrett.
514	Red soil	Dr. Janes, near Penfield	Greene		6	75.803	5.001	80.804	0.151	0.035	0.162	0.146	0.020	5.877	5.779	0.096	0.015	6.777	99.862	6.600	16.0	R. H. Loughridge.
515	Red subsoil of No. 514	do	do		6–9	73.805	7.155	80.960	0.128	0.014	0.077	0.180	0.150	4.343	9.572	0.055	0.008	4.832	100.319	5.180	16.0	Do.
516	Red soil	Near Milledgeville	Baldwin		6	82.402	3.340	85.742	0.134	0.034	0.132	0.353	0.039	3.803	4.554	0.080	0.029	5.382	100.232	4.890	11.0	Do.
149	Red soil	Near Elberton	Elbert	Red, white, and post oaks, pine, dogwood, hickory, and chestnut.	5	73.690	3.370	77.060	0.176	0.004	0.090	0.112	0.146	5.989	7.305	0.071	0.055	8.891	99.899	15.980	22.0	Do.
150	Red clay subsoil	do	do		5–12	81.820	4.010	85.830	0.131	0.080	0.081	0.037	0.072	5.177	4.383	0.051	0.069	3.506	99.417	3.788	20.0	Do.
	CENTRAL COTTON REGION.																							
166	Red hill soil	6 miles southwest of Lumpkin.	Stewart		6	73.422	2.709	76.131	0.134	Tr.	0.219	0.289	0.164	4.054	10.598	0.069	0.035	8.309	100.002	7.510	16.0	R. H. Loughridge.
322	Dark sandy upland soil	4 miles east of Fort Gaines	Clay	Long-leaf pine and oak undergrowth.	3	90.230	1.940	92.170	0.067	0.009	0.119	0.090	0.313	1.927	2.141	0.111	0.054	2.881	99.882	2.906	14.0	C. Cory.
323	Red sandy subsoil	do	do		3–9	91.330	2.350	93.680	0.047	0.034	0.086	0.087	0.167	2.442	2.295	0.084	0.166	0.993	100.081	2.222	15.0	Do.
252	Dark sandy soil	J. S. Green's, Chockopcreek	Lee	Long-leaf pine, red oak, and scanty undergrowth.	7	92.460	1.550	94.010	0.096	0.036	0.076	0.083	0.040	0.843	2.649	0.039	0.045	2.354	100.270	2.125	21.0	Do.
266	Red hill soil (buhr-stone)	South of Americus	Sumter		6	84.501	1.699	86.200	0.075	0.068	0.081	0.177	0.082	3.013	6.507	0.066	0.041	4.193	100.503	4.372	20.0	R. H. Loughridge.
359	Gray soil	Near Bushyville	Houston	Post, red, white, and black-jack oaks, hickory, and pine.	3	90.681	1.885	92.566	0.275	0.130	0.055	0.048	0.172	1.837	1.436	0.105	0.034	3.682	100.340	2.966	16.0	J. B. Durrett.
360	Yellow loam subsoil	do	do		3–9	88.990	1.985	90.975	0.290	0.061	0.065	0.067	0.061	1.860	3.282	0.102	0.085	2.580	99.338	4.188	16.0	Do.
361	Red sandy soil	5 miles east of Louisville	Jefferson	Hickory, post, and red oaks.	5	92.730	1.383	94.113	0.180	0.095	0.110	0.075	0.158	1.188	1.770	0.128	0.348	1.511	99.676	1.673	16.0	Do.
362	Red clay subsoil	do	do		5–9	86.872	3.724	90.596	0.330	0.145	0.120	0.110	0.220	2.016	3.941	0.224	0.273	1.646	99.621	2.163	16.0	Do.
	SOUTHERN OAK, HICKORY, AND PINE REGION.																							
307	Gray soil	Ocopilco	Brooks	Red, post, and white oaks, and hickory.	6	94.428	0.529	94.957	0.209	0.069	0.141	0.031	0.101	0.661	1.195	0.103	0.046	3.113	100.626	1.705	21.0	J. B. Durrett.
308	Gray subsoil	do	do		6–10	80.070	5.528	85.598	0.255	0.114	0.046	0.025	0.089	2.172	4.551	0.183	0.025	2.829	95.887	3.797	22.0	Do.
161	Gray upland soil	15 miles southwest of Thomasville.	Thomas	Long-leaf pine, some oak, and hickory.	10	92.726	0.701	93.427	0.042	0.042	0.019	0.016	0.108	1.427	1.780	0.021	0.026	3.099	100.007	2.180	12.0	R. H. Loughridge.
165	Open pine woods soil	Thomasville	do	Long-leaf pine	6	94.822	1.037	95.859	0.034	0.022	0.045	0.043	0.020	0.930	1.576	0.014	0.035	1.636	100.214	1.562	21.0	H. McCalley.
182	Hummock soil	Barrow's mill	Decatur	Red oak, hickory, poplar, and dogwood.	7	91.544	2.367	93.911	0.068	0.008	0.052	0.051	0.047	1.130	1.090	0.243	0.028	2.924	99.552	2.630	17.0	R. H. Loughridge.
	LONG-LEAF PINE AND WIRE GRASS REGION.																							
500	Sandy soil	Sylvania	Screven	Pine woods	6	93.050	0.866	93.916	0.320	0.168	0.129	0.116	0.103	0.672	1.095	0.125	0.125	3.617	100.386	2.950	16.0	J. B. Durrett.
501	Sandy subsoil	do	do		6–9	94.820	0.590	95.410	0.102	0.051	0.043	0.033	0.067	1.090	1.078	0.112	0.067	1.575	99.628	1.171	20.0	Do.
504	Black bottom soil	Brier creek	do		12	63.310	3.405	66.715	0.315	0.184	0.235	0.044	0.074	0.449	2.050	0.208	0.137	*29.150	99.561	12.840	20.0	Do.
509	Sandy pine woods soil	Near Lumber City	Telfair	Long-leaf pine and wire-grass.	6	93.354	1.101	94.455	0.094	0.078	0.022	0.156	0.018	0.974	2.262	0.039	0.082	*2.080	100.260	1.968	15.5	G. E. Colby.
510	Yellow sandy subsoil	do	do	do	6–12	73.480	4.245	77.725	0.251	0.169	0.035	0.326	0.031	4.418	11.659	0.024	0.290	5.278	100.206	8.752	15.5	Do.
	COAST REGION.																							
511	Live-oak soil	2 miles southwest of Sunbury.	Liberty	Live-oak and pine	6	93.229	0.303	93.532	0.062	0.153	0.106	0.178	0.039	0.285	0.619	0.067	0.180	4.869	100.090	3.210	....	G. E. Colby.
512	Live-oak subsoil	do	do		6–12	95.355	0.674	96.029	0.136	0.070	0.039	0.136	0.015	0.429	0.742	0.036	0.141	2.509	100.282	2.419	14.5	Do.
513	Rice-land soil	Savannah	Chatham		6	63.444	11.325	74.769	0.242	0.079	0.387	0.508	0.052	3.894	18.454	0.071	0.055	6.843	100.354	10.720	13.0	R. H. Loughridge.

* See humus table.

Determination of humus and analysis of its ash from the above soils.

Number.	Name.	Locality.	County.	Humus.	Available inorganic or ash.	PERCENTAGES REFERRED TO THE SOIL.							Analyst.
						Phosphoric acid.	Potash.	Soda.	Lime.	Magnesia.	Iron and aluminа.	Silica.	
517	Dark mulatto soil...	Cedartown	Polk	2.153	1.378	0.036	.....	.....	.....	.....	.....	0.701	G. E. Colby.
518	Mulatto soil	Near Adairsville	Bartow	1.852	0.606	0.016	0.059	0.004	.....	.....	.....	.....	R. H. Loughridge.
519	.....do	Near Adairsville (cultivated 100 years).	..do	1.774	1.313	0.027	0.027	0.020	.....	.....	.....	.....	Do.
504	Black bottom soil...	Brier creek	Screven	15.913	1.264	0.127	.....	.....	0.171	0.015	0.916	0.169	G. E. Colby.
509	Sandy pine woods soil	Near Lumber City	Telfair	0.836	1.298	.....	.....	.....	.....	.....	.....	.....	Do.
511	Live-oak land.....	Sunbury	Liberty	3.776	0.312	.....	.....	.....	.....	.....	.....	.....	Do.

PART II.

AGRICULTURAL DESCRIPTIONS

OF THE

COUNTIES OF GEORGIA.

The general directions of the drainage from a water-divide that crosses the county in a northeast and southwest direction are no thward into the Tennessee river and southward to the Coosa river.

About one-eighth of the county is mountainous, (*a*) and, including with this the steeper portion of "the ridges", about one-fifth of its surface is probably too steep for cultivation. The mountain sides are generally rich, and are covered with a heavy growth of timber. The lands of the county outside of the table-lands are all more or less calcareous. The larger portion of the lands of McLemore's cove, continuing toward the north side of the county in West Chickamauga valley and for several miles in Chattanooga valley, embrace rich calcareous soils. The same lands are also found in Duck and Dry Creek valleys continued north of the water-divide in Crawfish valley, and is found again in Dry valley and at the western base of Taylor's ridge. Lands similar to these in character of productiveness, but with a dark red soil, are found in the valleys west of John's, Horn's, and Chattoogata mountains. The area of these valleys altogether amounts to about 95 square miles, about 40 per cent. of which is cleared and under cultivation. These valleys have fine clover lands, and have been devoted mostly to corn, wheat, and oats. Lands having a brown loamy soil, containing much less clay and more sand than those of the above-named valleys, are found in West Armuchee valley, in the shinbone valleys, and for a few miles in the northern part of Chattanooga valley. These lands have an extent of 57 square miles, with 75 per cent. under cultivation, and are well adapted to corn, wheat, and oats, and are nearly the only lands on which cotton has been grown with success without fertilizers. West Armuchee valley is nearly the only locality in the county in which this crop was grown to much extent before the recent general use of commercial fertilizers. Peavine and Chattooga valleys and a part of East Armuchee valley afford a brown clay soil, covering an area of 35 square miles, with 40 per cent. under cultivation. (See analyses of soils, pages 25 and 27.)

The table-land, with a sandy soil, has an extent of 70 square miles, and "the ridges", with a gray gravelly soil, occupy 120 square miles. About 5 per cent. of these consist of cleared lands, and perhaps about one-fourth of the entire area of each is either too steep or else too rocky for cultivation. The soils of the alluvial lands are generally argillaceous, though those on West Armuchee creek and portions of Chattanooga and Duck creeks are somewhat sandy. The county has a great number of streams, most of which are small; but the creek bottoms constitute in the aggregate a considerable proportion of the cultivated lands.

ABSTRACT FROM THE REPORT OF J. A. CLEMENTS, OF VILLANOW.

Cotton is late in maturing on lowlands unless they are dry and sandy; hence the chief soil cultivated in cotton is the *sandy or gravelly* and more or less *calcareous upland*. This upland is rather level, covers about 40 per cent. of this region, and consists of narrow valleys, coves, and basins, bordered by ridges or mountains. Its natural growth is red oak, hickory, walnut, Spanish oak, chestnut, etc. The soil is a brown and blackish coarse sandy and gravelly loam 5 inches thick. The subsoil is more clayey than the surface soil, is generally deep red, sometimes yellow, and does not require artificial drainage. It contains flinty concretions, soft "black gravel", and rounded and angular pebbles, and is underlaid by limestone with flinty concretions from 2 to 35 feet. This soil is generally easily tilled, is early, warm, and well drained, and is apparently best adapted to corn. The chief crops are corn, wheat, oats, and cotton, one-fourth of the cultivated area being planted with the latter. The plant attains a height of from 2 to 2½ feet, and is most productive at 2 feet. On dark, rich soil, and in wet seasons in June and July, the plant inclines to run to weed, which is restrained and bolling favored by planting closely and using fertilizers.

The seed-cotton product per acre when the land is fresh is 800 pounds, and 1,545 pounds make a 475-pound bale of lint which rates in the market as low middling. After 15 years' cultivation the product is 500 pounds per acre, 1,630 pounds making a 475-pound bale; but the staple is not quite so good as that from fresh land. Crab-grass is the most troublesome on this soil. About 3 per cent. of such land originally cultivated now lies "turned out", but by the help of fertilizers it produces well when again cultivated. Slopes are seriously damaged by washing and gullying, and the valleys are also slightly injured by the washings. Horizontalizing and hillside ditching are practiced to check the damage, and with good success when properly done.

ABSTRACTS FROM REPORTS OF J. A. CLEMENTS AND W. F. TAPP, OF VALLEY STORE (CHATTOOGA COUNTY), AND F. M. YOUNG, OF GREENBUSH (ARMUCHEE VALLEY).

Clay and slaty red and yellow lands.—This soil covers from 35 to 50 per cent. of this region, and extends over the ten counties of northwest Georgia. The soil varies from a clay loam to clay, and in color from gray to yellow, brown, and blackish, and is 6 inches deep. The subsoil is usually yellow, but sometimes red, heavier than the surface soil, is impervious when undisturbed, and improves by cultivation and exposure at the surface. It is underlaid at from 1 foot to 20 feet by soft, red, slaty rock or shales, and in places by limestone. The soil is easy to till in dry, but difficult in wet seasons, is early, warm, and well drained, and is apparently best adapted to wheat, corn, cotton, and oats. One-third of it is planted in cotton. The usual and most productive height of the plant is from 2½ to 3 feet. Too much rain in July and August inclines it to run too much to weed, but this may be restrained and bolling favored by shallow cultivation, close planting, topping, and the use of highly ammoniated fertilizers. The product of seed-cotton per acre of fresh land is from 750 to 1,000 pounds, 1,525 pounds making a 475-pound bale of lint, which rates in the market as middling. After twenty years' cultivation the product of seed-cotton per acre is 400 pounds, 1,515 pounds then making a 475-pound bale of lint, which rates lower than that from fresh land. Crab-grass is the most troublesome weed. About one-tenth of this land originally cultivated now lies "turned out", and when again cultivated does not produce as well as when first cleared. Slopes in some places are damaged by the washing and gullying of the soil, but the washings damage the valleys very slightly in some places and improve them considerably in others. To check the damage hillside ditching, horizontalizing, and deep plowing are practiced, with good success; hillside ditching is least effectual.

Bottom lands.—The creek bottoms form about one-fifteenth of the land of this region. They bear a natural growth of white oak, hickory, walnut, poplar, maple, and chestnut. The soil is a dark-colored, fine sandy and gravelly loam, 7 inches thick. The soil is apparently best adapted to cotton and corn, but one-half of it is planted in cotton. The plant attains the height of from 3 to 4 feet, and is most productive at 3 feet. It inclines to run to weed in wet seasons, which may be restrained by heavy fertilizing, close planting, and shallow cultivation. The seed-cotton product per acre of fresh land is from 1,000 to 1,600 pounds, 1,485 pounds making a 475-pound bale of lint, which rates in the market as middling. After from fifteen to forty years' cultivation the product per acre is 1,000 pounds, the ratio of seed to lint and the quality of the staple being about the same as in the case of fresh land. The most troublesome weed is crab-grass. None of this land lies "turned out".

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a In the table-lands of Lookout and Pigeon mountains the escarpments only are included in this estimate.

DADE.

Population: 4,702.—White, 3,618; colored, 1,084.
Area: 180 square miles.—Woodland, all.
Tilled lands: 17,148 acres.—Area planted in cotton, 32 acres; in corn, 8,336 acres; in wheat, 3,996 acres; in oats, 2,999 acres.
Cotton production: 12 bales; average cotton product per acre, 0.38 bale, 534 pounds seed-cotton, or 178 pounds cotton lint.

Lookout valley, with an average width of about 3 miles, extends across Dade county in a northeasterly and southwesterly direction between the table-land of Lookout mountain on the east and that of Sand mountain on the west. The altitude varies from 600 to 800 feet above sea-level, while the table-lands on each side rise from 800 to 1,200 feet above the valley. Two nearly parallel ridges of from 100 to 200 feet in height subdivide the main valley for most of its extent into three divisions, and the portions lying between these ridges and the mountains are usually quite narrow and trough-shaped, and are known as the "back valleys". A large portion of the county lies on the Lookout and Sand mountain table-lands.

The county is drained northward into the Tennessee river by Lookout creek and its tributaries, with the exception of a small area in the northwestern corner of the county.

The valley lands are not surpassed in productiveness by any of equal extent in the state, the soils being all More or less calcareous, that of the central part of the valley being especially well suited to cereals, grasses, and clover. Some of these lands are nearly level, others are rolling, while toward the northern terminus of the valley they become quite hilly and afford a better yield of wheat. The soils of the back valleys are generally somewhat sandy. (For a description of the table-lands see page 28.)

Very little cotton has been planted in this county; but from the present rate at which the area of cotton culture is extending in the adjoining county of Walker and elsewhere in the state, where neither the land nor the climate can be better suited, it may be inferred that this crop may soon become an important production of the county, especially on the sandy lands of the back valleys and on Lookout and Sand mountains.

ABSTRACTS FROM THE REPORTS OF T. J. LUMPKIN, M. D., OF RISING FAWN, AND W. A. CHAMBERS, OF MORGANVILLE.

The cotton-plant grows large and bolls well, but it is rather cold, and the seasons are so short here that the bolls do not open well unless fertilizers are used. The chief soil cultivated in cotton is the *sandy loam*, in patches, for example, on the second bottom of Lookout creek, near Lookout mountain, which covers about one-fifth of this region, and extends about 30 miles north and much farther in other directions. It bears a natural growth of hickory, oaks, chestnut, walnut, poplar, beech, gums, and pine. The soil varies from a fine sandy to a gravelly loam, and from whitish-gray to yellow, brown, and black in color, and has a depth of from 1 foot to 4 feet. The subsoil is a heavy mulatto clay hard-pan (on the uplands it is a stiff, reddish clay), contains hard, white, rounded gravel, and is underlaid by hard limestone at from 3 to 40 feet. Tillage of this soil is difficult in wet but rather easy in dry seasons, and the soil is early and warm when well drained.

The chief crops are corn, wheat, and oats, but the soil is apparently best adapted to corn and wheat. Not more than one-fiftieth of the cultivated area of this soil is planted in cotton. The seed-cotton product per acre is from 1,000 to 1,500 pounds when the land is fresh, the lint rating as middling. Old land produces from 500 to 1,000 pounds of seed-cotton per acre, and 1,545 pounds then make a 475-pound bale of lint, which is a little shorter than that from fresh land. Crab-grass is the worst weed, cocklebur being the next. The soil on slopes washes and gullies readily, but farmers prevent serious damage by horizontalizing and hillside ditching. The valleys are damaged only to a very limited extent by the washings.

The second kind of land is designated as *black lime land*, and extends from the Tennessee river on the north to the Coosa river on the south. The soil is a black calcareous loam from 2 to 8 inches deep, underlaid by a hard, heavy mulatto subsoil, which is again underlaid by limestone at from 8 to 40 feet. Tillage of this land is easy in dry but difficult in wet seasons. The soil is late and cold, but well drained, and is apparently best adapted to corn. Very little cotton is planted on it.

Dade county is connected with Chattanooga and Rome by rail, freight being from 50 cents to $1 per bale.

CHATTOOGA.

Population: 10,021.—White, 7,981; colored, 2,040.
Area: 400 square miles.—Woodland, all.
Tilled lands: 50,802 acres.—Area planted in cotton, 12,906 acres; in corn, 20,078 acres; in wheat, 7,930 acres; in oats, 6,044 acres; in rye, 95 acres.
Cotton production: 5,247 bales; average cotton product per acre, 0.41 bale, 579 pounds seed-cotton, or 193 pounds cotton lint.

The mountains and steep sandstone ridges of Chattooga county cover altogether about 68 square miles, and the low, nodular ridges 110 square miles. Of the 170 square miles of comparatively level areas about 30 are situated on table-lands of Lookout mountain, ranging in altitude from 1,200 to 2,000 feet above the sea, and the remaining area is in valleys ranging in altitude from 700 to 800 feet. Nearly one-fourth of the valley lands have a brown-loam soil, embracing mostly those on the east of Taylor's ridge, and particularly the lands of Dirt Town and Shinbone valleys.

Broom Town valley and Chattooga valley cross the county between Lookout mountain and Taylor's ridge and are parallel with them. These afford good clay lands, commonly distinguished here as *mulatto lands*, and are uniformly productive where there is a good depth of clay or subsoil above the underlying shales, as is the case with most of the extent of these two valleys. The area is about 45 square miles.

Of the more calcareous lands, of which there are about 30 square miles, some lying next to Taylor's ridge, on the west, have a dark red soil; and that of Dry valley, and some of the lands immediately east of Shinbone ridge, have a brown and sometimes a gray soil, with an intermixture of gravel, derived from the bordering ridges.

The result of recent trials in the cultivation of cotton with fertilizers on the sandy lands of Lookout mountain is very favorable. The lower average temperature on the table-lands in comparison with the valleys is perhaps

more than counterbalanced by its greater uniformity, there being but little difference in the daily minimum temperature, and by the general absence of chilling dews, as well as by a less severity and a longer delay of frosts in the fall.

The gray gravelly lands extend over nearly one-third of the surface of the county. The improved lands of this class, of which there is but a small proportion, are confined mainly to the borders of the ridges to which they belong.

There are fine bodies of alluvial lands along the Chattooga river and many of the smaller streams. The bottom lands east of Taylor's ridge, and those of some of the streams running from Lookout mountain, are sandy to some extent. The cotton crop is sold either at Trion Factory, in this county, or in Rome.

ABSTRACTS FROM THE REPORTS OF A. P. ALLGOOD, OF TRION FACTORY, AND C. D. HILL, OF RACCOON MILLS.

The chief soil is commonly designated *gray land*, which includes about three-fourths of the cultivated land of this region and extends throughout the county. Its chief timber is oak and hickory. It is a gravelly clay loam of a gray color 6 inches thick. The subsoil is red and white clay, somewhat leachy, which contains "black gravel" and angular white pebbles. In some places it is underlaid by clay, and in others by limestone, not far from the surface. The soil is rather easily tilled in dry seasons, is somewhat early and generally well drained, and is best adapted to cotton, corn, and oats, which, together with wheat, potatoes, and sorghum, are the chief crops of this region. About two-fifths of this soil is planted in cotton. The plant attains a height of 3 feet, at which it is most productive. Wet, hot seasons and deep culture incline it to run to weed, but this may be checked and bolling favored by surface cultivation or by topping, or by both.

The product of seed-cotton per acre of fresh land is from 800 to 1,000 pounds, 1,450 pounds being required for a 475-pound bale of lint rating as middling. After five years' cultivation the product is from 300 to 600 pounds of seed-cotton, and 1,500 pounds make a 475-pound bale of lint, which is shorter, but otherwise better than that from fresh land. The troublesome weeds are rag-weed and crab-grass. Some of this land has been lying out only because the fences were destroyed during the late civil war and have not been rebuilt till recently; such are now the best cotton lands in this region. Slopes are somewhat injured by washing and gullying, but the valleys are improved by the washings. Horizontalizing is successfully practiced to check the damage.

Additional descriptions of the mulatto and bottom lands, by C. D. Hill.

The *mulatto soil* forms a small part of the cultivated area, and occurs in patches in many parts of the county. Its growth is oak, hickory, chestnut, poplar, with occasionally walnut. The soil is a mahogany-colored loam from 8 to 12 inches thick, and is generally gravelly. The subsoil is a very red clay, free from gravel or grit, and excellent for making brick; in some places it contains "black gravel". Limestone underlies it at various depths. The soil is comparatively easy to cultivate in wet or dry seasons, is early and moderately well drained, and is apparently best adapted to corn and wheat. Cotton does very well in some seasons, but in others does not open well. One-third or more of this soil is planted in cotton. The plant attains a height of from 3 to 4½ feet, but is most productive at 3 feet. It inclines to run to weed generally, and the tendency is increased by too much rain and by deep plowing.

The seed-cotton product per acre of fresh land varies from 600 to 1,200 pounds, about 1,485 pounds making a 475-pound bale of lint, which is of good quality, but is a little rough. After five years' cultivation the product is from 400 to 800 pounds per acre, and about 1,515 pounds then make a 475-pound bale of lint, which is not so long, but is of better quality than that from fresh land.

Rag- and hog-weeds, and especially crab-grass, are most troublesome on this soil. Little or none of such land lies "turned out", as it is more durable than the gray land and has a better subsoil. The slopes are not so much damaged by washing and gullying as those of the gray land. The *bottoms*, varying in width from 100 yards to half a mile, are as long as the streams, and bear a natural growth of poplar, sweet gum, wild cherry, beech, white oak, and hickory. The soil varies from brown to black, is from 2 to 3 feet thick, and is composed of fine silt and sand. The subsoil is fine sandy, and makes a transition into leachy, crawfishy clay below, which is in some places underlaid by rock at from 10 to 20 feet below the surface. The soil is easily tilled in dry seasons, is late, cold, and frequently ill drained, and is best adapted to corn and clover. Very little cotton is planted on it, because it is subject to rust. The plant frequently grows from 5 to 7 feet high, but is more likely to bear a crop when from 3 to 4 feet high, yielding from 600 to 1,200 pounds of seed-cotton per acre. After five years' cultivation the product is not diminished; the ratio of seed to lint is the same, the staple is perhaps smoother, and the plant is less inclined to run to weed. The most troublesome weeds are cocklebur, Spanish needle, and crab-grass. None of this land lies turned out.

Shipments are made to Rome, by wagon, commencing on the 15th of October, freight being $2 per bale.

GORDON.

Population: 11,171.—White, 9,347; colored, 1,824.

Area: 360 square miles.—Woodland, all.

Tilled lands: 69,467 acres.—Area planted in cotton, 8,668 acres; in corn, 22,661 acres; in wheat, 14,239 acres; in oats, 6,069 acres; in rye, 169 acres.

Cotton production: 3,301 bales; average cotton product per acre, 0.38 bale, 543 pounds seed-cotton, or 181 pounds cotton lint.

There are two ranges of mountains in Gordon county running nearly parallel, Horn's and Salacoa, respectively on the west and east side of the county. The intermediate portion of nearly 20 miles' width is subdivided into narrow valleys by bands of knobby ridges.

A large proportion of the cultivated area is of the alluvial lands of the Oostenaula river and its tributaries. The large streams of the county are remarkably crooked, and their broad bottom lands can hardly be excelled in productiveness. Between Horn's mountain and the Oostenaula river there is a fine body of rolling uplands with brown loam soils (see general description). The lands of this character have an extent of 25 square miles. Most of the valley uplands east of the Oostenaula river, covering 90 square miles, are brown or red clay lands underlaid by shales, and are of the character often designated as "mulatto lands". The gray gravelly lands have an area of nearly 70 square miles, in two sets of ridges running through the central portion of the county. The eastern belt of ridges has a width of 3 or 4 miles, and contains some sandy land. On the western side of the county there is a section of several miles in width, extending nearly through the county, covered with steep, slaty hills. These lands are generally poor and but little cultivated. The Oostenaula and the Coosawattee rivers are navigable for small boats for a part of the year.

ABSTRACT FROM THE REPORT OF AARON ROFF, OF CALHOUN.

The river lands are sandy and earlier than the valleys of the uplands, and are therefore better for cotton. The lands cultivated in cotton are the gray sandy, the chocolate-colored calcareous, and the red soils. The *gray sandy soil*, covering one-fourth of the area of this region, is known to extend 20 miles in each direction, and bears a natural growth of hickory, walnut, poplar, pine, and oak. The soil is a fine sandy and gravelly loam, chiefly of a gray color, and is 6 inches deep. The subsoil is a red clay, and is underlaid by rock. The soil is late and cold, and is difficult to cultivate in wet seasons. The average size of farms is 300 acres, and the chief crops are corn, wheat, oats, and cotton; but the soil is apparently best adapted to cotton. The usual and most productive height of the cotton-plant is 3 feet. Rainy weather or excessive manuring inclines the plant to run to weed, which may be restrained and bolling favored by topping.

The seed-cotton product per acre of fresh lands is 800 pounds, the lint rating as first class. After five years' cultivation the product is 600 pounds per acre, with first-class lint. Hog-weeds and rag-weeds are most troublesome. No land of this kind now lies "turned out"; and that which was out is again cultivated, and produces as well as originally, and in some instances better than at first. Slopes wash and gully very little, and are not seriously damaged in this way, while the valleys are benefited by the washings. No efforts have been made to check the damage.

Shipments are made as fast as the cotton is ginned, by the Western and Atlantic railroad, to Atlanta, Rome, and Dalton, rate of freight being 12½ cents per 100 pounds.

FLOYD.

Population: 24,418.—White, 14,958; colored, 9,460.

Area: 540 square miles.—Woodland, all.

Tilled lands: 96,479 acres.—Area planted in cotton, 30,615 acres; in corn, 29,872 acres; in wheat, 9,251 acres; in oats, 8,413 acres; in rye, 52 acres.

Cotton production: 14,545 bales; average cotton product per acre, 0.48 bale, 678 pounds seed-cotton, or 226 pounds cotton lint.

The surface of Floyd county varies from nearly level to hilly and mountainous, the principal mountains being in the northwestern part of the county. The valleys in this portion of the county have a nearly level or rolling surface, and are not generally subdivided by ridges, as is common in most of the country to the north and west. The eastern side of the county is covered principally with cherty ridges, with two or three narrow valleys extending nearly north and south. The southern and southwestern portions are similarly divided, but have broader valleys and comparatively narrow ridges.

The large streams have but little fall, and take a winding course, with broad bottoms on one or both sides. The soil of the river bottoms, and that of some of the creeks, particularly in the northwestern part of the county, is sandy in such proportion as to promote easy culture. These sandy bottoms are among the most productive for all crops, with a special adaptation to the growth of cotton, yielding from 600 to 800 pounds of seed-cotton per acre without fertilizers. There are several valleys with rich calcareous lands in the southern and eastern parts of the county. Van's valley affords the largest body of these lands. (For description, see Cedar valley, Polk county.) The valleys in the northwestern part of the county have generally a brown loam soil, with here and there, next the mountains, a gray gravelly or rocky soil. The gravelly ridge lands cover a large proportion of the eastern and southern parts of the county. The "flatwoods" extend through the county near the Oostanaula and Coosa rivers. These land are generally level, are about 50 feet above the high water mark of these rivers, and are covered with a growth of short-leaf pine and scrubby red and post oaks. Cotton is grown here with success on the better lands without fertilizers, and is one of the chief crops on all cultivated land.

Rome is the chief market. The Coosa and Oostanaula rivers are navigable for small boats.

ABSTRACT FROM THE REPORT OF GEORGE S. BLACK, OF ROME.

The seasons are rather short for cotton. It is considered unsafe to plant before April 15, and killing frosts appear early in October; besides this, there are long, withering droughts through July and August. The south and east of the county are in the freestone region, the north and west in the limestone region, and we are on the division line. The soils are so various that it would be impossible to obtain a 100-acre field that would not contain two, or even four, qualities or colors of soil. It frequently happens that a small brook, over which one can step, divides two distinct qualities of soil in respect both to color and to production. This county has some very productive land, but it is scattered about in patches.

The soils cultivated in cotton are uplands, valleys, and bottoms of rivers and creeks, and vary in color from gray to brown, mahogany, and blackish, and are composed of coarse sand, gravel, and clay, in varying proportions, in different places. Very *sandy soil* is found only in narrow strips near water-courses. The natural timber growth is oak, hickory, pine, poplar, walnut, maple, beech, birch, ash, cherry, gum, etc. Such soils have an average thickness of 6 inches, and extend 70 miles west, 40 east, 50 north, and 100 miles south. The subsoils are heavier than the surface soils; those of river bottoms and valleys are red, very stiff and tenacious clays, and those of portions of creek bottoms and flat uplands are yellow clay and less tenacious. They contain "black gravel" and a variety of pebbles, white ones excepted, and are underlaid by gravel and rock at from 10 to 30 feet.

The soils are difficult to till in wet seasons, and are early and warm, but ill drained. The chief crops of this region are corn, cotton, oats, pease, potatoes, wheat, barley, rye, etc., the first five being best adapted to this region. Cotton occupies one-third of the soil. The plant attains the height of from 3 to 8 feet, the higher the more productive. It inclines to run to weed on rich bottom land, and elsewhere if there is too much rain; early topping will check it and favor bolling.

The product per acre of fresh land varies from 600 to 800 pounds of seed-cotton, 1,485 pounds making a 475-pound bale of lint, which rates in the market as middling. After ten years' cultivation the product per acre is 400 to 500 pounds on uplands and five- to seven-tenths more on bottoms, 1,545 pounds then making a 475-pound bale of lint, which does not differ in quality from that on fresh land.

The troublesome weeds are hog-, rag-, and smart-weeds, and crab-grass is worse than all the rest combined. Not more than one-twentieth of the arable land lies "turned out", and the producing capacity of it has not again been tried. The slopes wash and gully readily, but are not yet seriously damaged, while the valleys are rather improved by the washings. Some slight and only partially successful efforts have been made to check the washing by horizontalizing, hillside ditching, and terracing.

475-pound bale of lint, which is shorter than and inferior to that from fresh land. Rag-weeds, hog-weeds, and crab-grass are most troublesome. One-fortieth of this land lies "turned out". When again cultivated it produces as well as when fresh, but does not last so long. Slopes do not readily wash or gully, but in some instances they are seriously damaged. Horizontalizing and hillside ditching are successfully practiced to check the damage.

The *blackish clay bottom soil* includes one-fourth of the arable land of this region. The soil is 6 inches deep, and is late, cold, ill drained, and rather difficult to till in wet seasons. The subsoil is heavier, and is an impervious, yellowish clay hard-pan, underlaid by gravel and rock at from 15 to 20 feet. The soil is apparently best adapted to corn, but one-third of the cultivated area is planted in cotton. The plant attains a height of from 3 to 6 feet, but is most productive at 4 feet. It runs to weed in wet weather, for which there is no remedy. The seed-cotton product per acre is from 1,000 to 1,500 pounds; after thirty years' cultivation the product is 800 pounds. About 1,425 pounds from fresh land and about 1,460 pounds from old land make a 475-pound bale. The staple from old land is inferior to that from new, but the difference is hardly appreciable. The most troublesome weeds are rag-weeds, morning-glories, and grass. None of this land lies "turned out".

The *gray gravelly upland clay soil* includes one-fourth of the cultivated area of this region, and is 6 inches deep. It is known to extend 10 miles around, and bears a natural growth of post oak, red oak, pine, black-jack oak, etc. The heavier subsoil is a light yellow, very stiff, impervious hard-pan, containing flinty, hard, angular gravel of white and other colors, and is underlaid by rock at from 30 to 50 feet. The soil is early, warm, but ill drained, and is difficult to till in wet seasons. It is apparently best adapted to cotton, with which one-half its area is occupied. The plant attains a height of from 2 to 3 feet; is most productive at 3 feet, and is not inclined to go to weed. The seed-cotton product per acre of fresh land is from 400 to 600 pounds; after thirty years' cultivation it is no less; 1,485 pounds from fresh land, or from 1,485 to 1,545 pounds from old land, make a 475-pound bale of lint. The staple from old land does not differ appreciably from that of new land; both are good. Crab-grass is the most troublesome weed. One-tenth of this land lies "turned out", and after a long rest produces very well again. Slopes are seriously damaged by the washing and gullying of the soil upon them; the washings also injure the valleys to the extent of 5 per cent. To check the damage horizontalizing and hillside ditching are very successfully practiced.

Shipments are made, as soon as the cotton is ready, by rail, to Atlanta at $1 per bale.

THE BLUE RIDGE REGION (METAMORPHIC).

The Blue Ridge region embraces all of the counties of Rabun, Towns, Union, Fannin, Gilmer, Pickens, Dawson, Lumpkin, White, and Habersham. The north county-lines of the latter four rest on the crest of the ridge. The first five counties are out of the cotton region proper, and but a brief mention is necessary.

RABUN.

Population: 4,634.—White, 4,437; colored, 197.
Area: 400 square miles.—Woodland, all; metamorphic, all.
Tilled lands: 18,209 acres.—Area planted in cotton, 45 acres; in corn, 8,810 acres; in oats, 455 acres; in wheat, 457 acres; in rye, 1,675 acres.
Cotton production: 14 bales; average cotton product per acre, 0.31 bale, 444 pounds seed-cotton, or 148 pounds cotton lint.

Rabun county occupies the extreme northeastern corner of the state, and is a region of mountains with comparatively little land suitable for tillage. It is well timbered (one-half pine on the mountains), and its soils are chiefly gray, sandy, and gravelly, with clay subsoils. A belt of red land enters the county from the southwest and reaches to Clayton, the county-seat. (For description of lands, see regional part, page 32.) The Atlantic and Gulf water-divide passes northward through the western part of the county. The lands of the Tennessee valley (2,000 feet above the sea) are generally level and highly productive, and here also are situated the largest farms. The county is too broken and transportation to railroad stations too difficult to make the culture of cotton very profitable.

TOWNS.

Population: 3,261.—White, 3,157; colored, 104.
Area: 180 square miles.—Woodland, all; metamorphic, all.
Tilled lands: 14,198 acres.—Area planted in cotton, none; in corn, 7,001 acres; in oats, 830 acres; in wheat, 2,055 acres; in rye, 1,339 acres.
Cotton production: None.

Towns county lies on the north side of the Blue Ridge along the North Carolina line, and is drained by the headwaters of the Tennessee river, which flow northwestward. The surface is broken and well timbered. Its soils are gray, sandy, and gravelly, and underlaid by clay subsoils. (See regional description, page 32.)

No cotton is produced, except, perhaps, in small patches for home use. Corn is the chief crop, with some wheat and rye and a little oats.

NOTE FROM HOWELL C. STANDRIDGE, OF HIAWASSEE.—The soil, as a general thing, is of a dark gray color, though all varieties occur. Dark loamy soils are found on or near the mountains. Cotton in this county grows finely as far as the stalk is concerned, but does not mature. The seasons are too short and cold.

UNION.

Population: 6,431.—White, 6,321; colored, 110.
Area: 330 square miles.—Woodland, all; metamorphic, all.
Tilled lands: 30,347 acres.—Area planted in cotton, 12 acres; in corn, 14,347 acres; in oats, 2,139 acres; in wheat, 4,612 acres; in rye, 1,934 acres.

Cotton production: 5 bales; average cotton product per acre, 0.42 bale, 594 pounds seed-cotton, or 198 pounds cotton lint.

Union county lies chiefly on the north side of the Blue Ridge. Its surface is mountainous and broken, well timbered, and drained by streams forming in part the headwaters of the Tennessee river. Soils are mostly gray, sandy, and gravelly, with clay subsoils, as in the adjoining counties. (See regional description, page 32.) The chief crop is corn, with an acreage five times that of any other crop.

NOTE FROM C. J. WELLBORN, OF BLAIRSVILLE.—The seasons are too short, and the shade is too great in this county for the successful production of cotton for market. It is only planted in patches, and while the plant grows luxuriantly it fails to mature or to open before the frosts come. The *red clay lands*, while not the best of the county, are the only ones on which cotton is planted, and then fertilizers are used. They comprise 10 per cent. of the county area, and have a growth of all varieties of oaks, hickory, walnut, buckeye, white, yellow, and spruce pine, cherry, and poplar.

FANNIN.

Population: 7,245.—White, 7,112; colored, 133.

Area: 390 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 27,197 acres.—Area planted in cotton, none; in corn, 14,220 acres; in oats, 1,005 acres; in wheat, 3,649 acres; in rye, 2,099 acres.

Cotton production: None.

Fannin county, on the north side of the Blue Ridge, resembles in general the other counties of the region in its metamorphic rocks, sandy and red clayey soils and clay subsoils, and in its timber growth. Its drainage is northward to the Tennessee river. The lands are described in the following abstract.

Cotton is scarcely planted, except in small patches.

ABSTRACT FROM THE REPORT OF ADAM DAVENPORT, OF MORGANTON.

The lands of the county vary greatly from one ridge to another, being in patches of from 1 acre to 20 acres each. They may be classed as—

Black sticky uplands, lying mostly on southern slopes, and hence better for cotton than the other lands. They comprise about 12 per cent. of the lands of the county, and have a growth of hickory, oak, walnut, honey-locust, mulberry, and spicewood. The soil has a depth of 10 inches, with a clay subsoil. The chief crops are corn, wheat, rye, oats, and potatoes, to the first of which this soil is best adapted. Cotton is planted only in a few small patches for home use, and yields about 600 pounds per acre. The lands are early, warm, well drained, and difficult to cultivate in wet seasons.

The *heavy mahogany-colored clay uplands*, having eastern or southern inclinations, comprise one-half the lands, and have a growth of oak, chestnut, pine, hickory, and black-jack. They are best adapted to wheat or corn.

The *sandy bottom lands* of Toccoa river have a dark-gray soil 2 feet in depth, and a growth of walnut, hickory, fir, buckeye, maple, etc. These are best adapted to corn and rye. Cotton grows luxuriantly, but is liable to be killed prematurely by frosts. Under the most favorable circumstances only about 100 pounds of lint are obtained per acre from these lands.

GILMER.

Population: 8,386.—White, 8,258; colored, 128.

Area: 480 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 30,273 acres.—Area planted in cotton, 122 acres; in corn, 16,178 acres; in oats, 582 acres; in wheat, 5,903 acres; in rye, 950 acres.

Cotton production: 32 bales; average cotton product per acre, 0.26 bale, 375 pounds seed-cotton, or 125 pounds cotton lint.

Gilmer county lies at the southwestern termination of the Blue Ridge. Its surface is rolling and in part mountainous, is well timbered, and is drained westward by the headwaters of the Coosawattee river. In general soil features it resembles the region already described. There is, however, a smaller percentage of its lands under cultivation (9.9 per cent. of county area) than in any county of the region excepting Rabun. Its chief crops are corn, wheat, rye, and oats. Scarcely any cotton is planted.

PICKENS.

Population: 6,790.—White, 6,645; colored, 145.

Area: 230 square miles. Woodland, all; metamorphic, nearly all.

Tilled lands: 26,834 acres, or 18.2 per cent. of county area.—Area planted in cotton, 2,210 acres; in corn, 12,774 acres; in wheat, 5,992 acres; in oats, 1,619 acres; in rye, 357 acres.

Cotton production: 734 bales; average cotton product per acre, 0.33 bale, 474 pounds seed-cotton, or 158 pounds cotton lint.

Pickens county is divided diagonally by the continuation of the Blue Ridge chain passing through the county from northeast to southwest. These mountains have an altitude of from 1,500 to 2,500 feet, while the rest of the county is broken and hilly. On the north of this range the county is watered by Talking Rock creek and its tributaries, flowing northwestward into the Coosawattee river. On the south are the headwaters of Long Swamp and Stone creeks, flowing southward, tributaries of the Etowah river.

The various schists and gneisses are found over the greater part of the county, forming by their decomposition their characteristic sandy and mulatto lands. East from Jasper, the county-seat, mica-schists at first appear, then a wide belt of sandstones, and finally gneisses at the county-line. To the west and northwest are found shales, sandstones, and mica-schists, with hornblendes near Talking Rock, and the lands are mostly sandy, with red and yellow clay subsoils. Cotton is produced only in patches. Nineteen per cent. of the county area is too mountainous for tillage, and of the remainder 33 per cent. has been cleared and is partially under cultivation. Wheat yields 5

bushels, corn 15 bushels, and oats 8 bushels per acre. On the northwest, where the Pine Log range of mountains cross the county, there are found white marbles of excellent quality. In other sections gold and other minerals exist.

The lands under tillage comprise 18.2 per cent. of the county area. Of this 8.2 per cent. is in cotton, averaging 9.6 acres per square mile.

DAWSON.

Population: 5,837.—White, 5,479; colored, 358.

Area: 180 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 24,958 acres.—Area planted in cotton, 2,189 acres; in corn, 14,906 acres; in wheat, 4,649 acres; in oats, 882 acres; in rye, 186 acres.

Cotton production: 850 bales; average cotton product per acre, 0.39 bale, 552 pounds seed-cotton, or 184 pounds cotton lint.

Dawson county touches the Blue Ridge chain only on the northwestern corner, but the rest of the country is hilly and broken. The rocks are highly micaceous, with the exception of an area of sandstone northwest of Dawsonville. There is a belt of red hornblendic lands south of the town, but the lands in general are gray and sandy, with clay subsoils. The Chattahoochee and the Etowah rivers approach very near each other on the northeast, and are separated only by a low ridge. Twenty-one and seven-tenths per cent. of the county area is under tillage, and 8.8 per cent. of this is in cotton, averaging 12.2 acres per square mile. Ten per cent. of the county is too mountainous for tillage.

LUMPKIN.

Population: 6,526.—White, 6,075; colored, 451.

Area: 290 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 21,019 acres.—Area planted in cotton, 269 acres; in corn, 11,232 acres; in wheat, 2,781 acres; in oats, 1,554 acres; in rye, 582 acres.

Cotton production: 109 bales; average cotton product per acre, 0.41 bale, 576 pounds seed-cotton, or 192 pounds cotton lint.

Lumpkin is one of the chief gold-bearing counties of the state, Dahlonega being the center of large mining operations. The surface of the county is hilly, and in the north mountainous. The principal streams are the Etowah river and the Chestatee. Twenty-five per cent. of the county is too mountainous for tillage. The soils are of the gray sandy and red clayey varieties, with clay subsoils, usual to the metamorphic region. (See regional description, page 32.) The average yields are 12 bushels of corn, 7 of oats, and 15 of wheat per acre. The average of cotton product per acre is very high as compared with that of other counties of the metamorphic region. Tilled lands comprise 11.3 per cent. of the county area; of this 1.3 per cent. is devoted to cotton, which averages 0.9 acres per square mile.

Shipments are made by wagon to the nearest railroad station, and there mostly sold to local buyers.

John C. Brittain, of Dahlonega, says:

> The altitude of this county is too great for the cultivation of cotton, being from 1,600 to 3,500 feet above sea-level. Consequently no cotton, except a little for home use, is made in the county.

WHITE.

Population: 5,341.—White, 4,751; colored, 590.

Area: 180 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 19,889 acres.—Area planted in cotton, 228 acres; in corn, 11,097 acres; in oats, 2,228 acres; in wheat, 2,319 acres; in rye, 489 acres.

Cotton production: 68 bales; average cotton product per acre, 0.30 bale, 426 pounds seed-cotton, or 142 pounds cotton lint.

The surface of White county is rolling and broken, largely mountainous, and well timbered. The topographical and agricultural features are fully given in the following abstract, taken from the unpublished geological report on this county made by the late Professor F. H. Bradley, formerly of the state survey:

> Nearly half of the surface of White county is occupied by the spurs of the Blue Ridge, along whose crest lies the northern boundary-line. On the northeast we find the heavy mass of Tray mountain, with long, high spurs and deep, narrow valleys, including such small amounts of level land that all but the outermost portions are destitute of houses and fields. In the northwest, on the contrary, the Horse range, a distinct spur of the Blue Ridge, and running at right angles to its general trend through fully half the length of the county, furnishes considerable high, flat areas, upon which are located several farms. Between this and Buzzard mountain, still northwest, along Town's creek, a narrow belt of farms follows the Tessentee turnpike; and along Spoiled Cane creek, between the Horse range and Tray mountain, another belt follows the Unicoi turnpike far toward the crest of the divide. The valleys at the base of the mountains are from 1,500 to 1,700 feet above the sea, the mountains from 3,000 to 4,435 feet. Through the center and southern portion of the county there is a rather scattering string of isolated knobs, of which Yonah (3,168 feet high) is the most prominent. The valleys have mostly a southerly trend with the spurs of the Blue Ridge, excepting Nacoochee valley, which lies nearly due east and west and forms a sort of gathering place or "low-ground" for all the smaller streams, which here form the Chattahoochee river.
>
> The valleys have generally a fertile soil, and are mostly cultivated, producing good crops of corn and sorghum-cane, with smaller areas devoted to rice, hay, and pasturage. The second bottoms (or terraces, some 70 feet above stream-level) and lower uplands are mainly cultivated in corn and wheat, with some oats, tobacco, cotton, potatoes, etc., in small quantities for home use. Most of the bottom lands give evidence, by graves, pottery, implements, etc., of having been under cultivation for several centuries. While the vegetable portion of the soil has often recuperated through lying fallow for years and through having crops of weeds and grasses plowed under, yet the mineral portion has not thus been restored, except by the floods which occasionally overflow the lowest portions of the bottoms and deposit sediment.

The ridges of the lower half of the county are dry and mostly sandy. At the southern extremity they bear considerable areas of good yellow pine-timber, together with tracts of scrubby oak, hickory, etc. Passing northward, the pine rapidly decreases and the hard woods increase in amount and variety. In the northern and more mountainous portion the forests have been less cut away, and the ridges, as well as the valleys, are therefore more abundantly watered and covered with a heavy growth of large timber—white, red, and Spanish oaks, hickory, black walnut, maple, chestnut, poplar, locust, cherry, gum, hemlock, holly, sassafras, etc. The soil here is mostly a black loam, and is covered with a scattering undergrowth of sourwood, etc., and an abundant growth of pea-vines, wild grasses, etc., thus making this a favorite pasture-ground.

HABERSHAM.

Population: 8,718.—White, 7,357; colored, 1,361.
Area: 400 square miles.—Woodland, all; metamorphic, all.
Tilled lands: 28,365 acres.—Area planted in cotton, 1,762 acres; in corn, 14,797 acres; in wheat, 2,458 acres; in oats, 1,921 acres; in rye, 602 acres.
Cotton production: 597 bales; average cotton product per acre, 0.34 bale, 483 pounds seed-cotton, or 161 pounds cotton lint.

Habersham county has for its most prominent feature the various high mountain ranges and points, all well timbered. The Blue Ridge lies on the northern boundary, Tallulah mountain, an offshoot, trending southward to the Chattahoochee ridge. The surface of the country, exclusive of the mountains, is rolling, with valleys and uplands, and presents large areas of excellent lands for cultivation. Only 10 per cent. of the entire county is too hilly for tillage.

The rocks of the county comprise a great variety of the metamorphic series, and are highly siliceous. A belt of magnesian or talcose slates, with a limestone stratum of varying thicknesses, containing some galena, passes several miles south of Clarksville in a southwest course. The belt is so narrow that the lands on either side are not perceptibly benefited by the presence of the limestone. Lime-kilns have been in operation at several of these limestone exposures. The table-lands on the northeast have a sandy soil, derived from a dark sandstone (the almost exclusive rock), and are thinly settled, being too hilly for cultivation to any great extent.

Large areas of red-clay land occur in several portions of the county, especially on the north, where a belt 2 or 3 miles wide passes north of Batesville. (For description of lands and analyses, see general part, page 33.)

Tilled lands comprise 11.1 per cent. of the county area, and of this 6.2 per cent. is in cotton, averaging 4.4 acres per square mile.

The Raleigh and Augusta Air-Line railroad furnishes transportation to market.

ABSTRACT FROM THE REPORT OF C. H. SUTTON, OF CLARKSVILLE.

The *red lands* are the only ones devoted to cotton, and comprise the largest part of the area under cultivation. They have a soil 6 inches deep and a mica-clay subsoil. The growth is pine, oak, hickory, chestnut, ash, etc. Cotton comprises one-twentieth of the crops, and fertilizers are used to hasten its maturity. The yield is from 300 to 800 pounds of seed-cotton. The crops are troubled most with rag-weeds, cocklebur, Spanish needles, and crab-grass. The uplands wash readily if there is much mica-clay in the soil, otherwise not. But little damage is done. The crops of the county are corn, wheat, oats, potatoes, etc.

MIDDLE GEORGIA (METAMORPHIC).

This region embraces the counties of Franklin, Hart, Banks, Hall, Forsyth, Milton, Cherokee, part of Bartow,* Haralson, Paulding, Cobb, Fulton, De Kalb, Gwinnett, Jackson, Madison, Elbert, Oglethorpe, Clarke, Oconee, Walton, Rockdale, Clayton, Campbell, Douglas, Carroll, Heard, Coweta, Fayette, Spalding, Henry, Newton, Morgan, Greene, Taliaferro, Wilkes, Lincoln, and Columbia; parts of McDuffie, Warren, and Hancock; Putnam, parts of Baldwin, Jones, Bibb, and Jasper; Butts, Monroe, Pike, Upson, parts of Crawford, Taylor,* Talbot, Meriwether, Troup, Harris, and Muscogee.

FRANKLIN.

Population: 11,453.—White, 8,906; colored, 2,547.
Area: 330 square miles.—Woodland, all; metamorphic, all.
Tilled lands: 61,117 acres.—Area planted in cotton, 16,901 acres; in corn, 20,523 acres; in wheat, 6,520 acres; in oats, 4,627 acres; in rye, 15 acres.
Cotton production: 5,723 bales; average cotton product per acre, 0.34 bale, 483 pounds seed-cotton, or 161 pounds cotton lint.

The surface of Franklin county is rolling and hilly, 5 per cent. being too much so for tillage. It is well timbered, and comprises the usual gray, sandy, and gravelly, as well as red-clay lands. (See regional description, page 34.) The latter chiefly prevails, a wide belt of a deep red color, derived from hornblendic rocks, passing through from northeast to southwest. These are frequently covered by thin layers, 2 or 3 inches deep, of sandy soils, which, by intermixture with the clays, produce a mulatto soil, usually dark from decayed vegetation. The growth is hickory, dogwood, and various oaks. Twenty-eight and nine-tenths per cent. of the area of the county is under tillage, 27.7 per cent. of these lands, averaging 51.2 acres per square mile, being in cotton. Corn, wheat, and oats are the other chief crops.

ABSTRACT FROM THE REPORT OF O. C. WYLY, OF CARNESVILLE.

The lands of the county are intermixed very generally, and comprise the red and the gray sandy and gravelly. The general yield is 400 pounds of seed-cotton per acre on fresh lands, and an increase of 100 or 200 pounds after four years' cultivation. The lint rates as middling. One-sixth of the lands now lies out; they wash readily, doing much damage. These old lands produce cotton finely, and are troubled chiefly with crab-grass and hog-weed.

Shipments of cotton are made by the Elberton and Air-Line railroad, or by wagon, to Athens, at 50 cents per 100 pounds.

HART.

Population: 9,094.—White, 6,212; colored, 2,882.

Area: 330 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 39,759 acres.—Area planted in cotton, 14,923 acres; in corn, 14,312 acres; in wheat, 4,646 acres; in oats, 4,876 acres; in rye, 10 acres.

Cotton production: 5,094 bales; average cotton product per acre, 0.34 bale, 486 pounds seed-cotton, or 162 pounds cotton lint.

Hart is a rolling, timbered county, with level table-lands between the streams. Gray sandy lands, from mica-schists, cover almost the entire county south from Hartwell and north for several miles. Red lands then prevail to the Franklin county line, formed from the decomposed hornblende rocks. (For character of lands, etc., see general description, page 29.) All of the lands of the county are considered tillable. The lands under cultivation comprise 18.8 per cent. of the county area; 37.5 per cent. of tilled lands is planted in cotton, averaging 45.2 acres per square mile. Its yield per acre is a little more than the average for the region.

ABSTRACT FROM THE REPORT OF C. W. SEIDELL, OF HARTWELL.

The gray lands are chiefly devoted to cotton. They cover two-thirds of the county, lie along the uplands at some distance from the creeks and rivers, have a sandy gray upland loam soil from 3 to 4 inches in depth, with generally a red-clay subsoil, and contain much quartz gravel. The growth is principally pine, with some oak, hickory, gums, ash, etc. The soil is early and easily tilled, producing cotton, corn, wheat, rye, oats, and potatoes. Cotton comprises two-thirds of the crop, grows to a height of 3 or 4 feet, runs to weed on very rich land, and yields about 250 pounds of seed-cotton per acre. Cultivation of three years improves it and increases the yield to 375 and 400 pounds. Crab-grass is the most troublesome weed. Very little of the land now lies out, and it washes but slightly on slopes. The bottoms of Savannah river are rich and productive, and are best adapted to corn. In this county the cotton crops are cut short by early frosts in the fall, but this is obviated by the use of fertilizers, which causes cotton to open in time to prevent damage.

Shipments are made to Augusta, Charleston, and Baltimore. The rates of freight are $3 25 to Baltimore and $2 75 to Charleston per bale.

BANKS.

Population: 7,337.—White, 5,830; colored, 1,507.

Area: 320 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 31,261 acres.—Area planted in cotton, 8,251 acres; in corn, 11,789 acres; in wheat, 3,036 acres; in oats, 2,022 acres; in rye, 24 acres.

Cotton production: 2,960 bales; average cotton product per acre, 0.36 bale, 510 pounds seed-cotton, or 170 pounds cotton lint.

Banks county, with its northern boundary resting on the Chattahoochee ridge at an elevation of a little over 1,600 feet above the sea, gradually declines southward from the foot of the ridge, the general elevation being then about 700 feet. The surface of the country is hilly, 2 per cent. being too much broken for successful tillage. Sixty-seven per cent. of the entire county is still covered with its original timber-growth of oaks, short-leaf pine, chestnut, hickory, and gum on the uplands, and gum, ash, maple, oak, and poplar on the bottoms and lowlands. The tributaries of Broad river flowing southeast into the Savannah drain the surface of the county.

The usual variety of gray sandy and red clayey soils, with their clay subsoils, occur throughout the county. (See general description, page 34.)

Red clay lands cover the southern portion of the county, and a narrow belt lying 6 miles north of Homer extends in a southwesterly course across the county. These red lands are interspersed throughout with gray sandy soils, while the rocks, though chiefly hornblendic, are associated with gray and micaceous gneisses. The lands along the streams are sandy, while the bottoms are narrow and present but small areas suitable for cultivation. The lands devoted to the cultivation of cotton are the uplands, which have a depth of from 6 to 10 inches and a red-clay subsoil.

The cultivated lands comprise 15.3 per cent. of the county area. Cotton is the second crop in acreage, and averages 25.8 acres per square mile, or 26.4 per cent. of tilled land. Its average product per acre is above that of the region at large, and also of the state.

ABSTRACT FROM THE REPORT OF C. C. SANDERS, OF GAINESVILLE.

This county is too near the mountains to produce cotton well. The cold and late springs incident to the high elevation above sea-level retard the growth of cotton in early spring and the early frosts of autumn prevent opening. With fertilizers and good cultivation the crops since the war have generally come in in sufficient time. Several classes of land may be distinguished, viz:

1. *The red, gray,* and *mulatto uplands,* covering three-fourths of the county, and best adapted to corn, wheat, oats, and potatoes, though cotton comprises one-third of the crops, and yields on fresh lands 800 pounds of seed-cotton per acre. After five years' cultivation (unmanured) the yield is only from 300 to 500 pounds, and 1,545 pounds are required for 475 pounds of lint. The stalk grows to an

average height of 3 feet, is most productive at 2½ feet, and inclines to run to weed in wet weather after a drought. Crab-grass is the most troublesome enemy to contend with. While these uplands wash readily on slopes, the damage done is but slight, and the valleys are benefited by the deposits of sand and clay.

2. The *light sandy lands* extend but 2 or 3 miles along small creeks, are 1 foot in depth, and have a heavy clay subsoil. They are late, cold, and well drained, easy to cultivate, yielding, when fresh, 1,000 pounds of seed-cotton per acre. After five years' cultivation the yield is from 600 to 900 pounds. But one-tenth of this land is planted in cotton, which grows to a height of about 4 feet, but is most productive at 3 feet.

3. The *high and dry sandy bottoms* of the creeks comprise but a small area for several miles along the creeks, and have a growth of oak, gum, poplar, and a depth of 18 inches. They are early, warm, and easy to cultivate in dry weather, and but very little cotton is planted on them. They yield from 1,000 to 1,500 pounds of seed-cotton per acre when fresh, and from 800 to 1,000 pounds after five years. Very little, if any, of the lands of the county is turned out to rest. Shipments of produce are made by railroad to Gainesville.

HALL.

Population: 15,298.—White, 13,040; colored, 2,258.
Area: 540 square miles.—Woodland, all; metamorphic, all.
Tilled lands: 64,981 acres.—Area planted in cotton, 12,245 acres; in corn, 26,632 acres; in wheat, 8,771 acres; in oats, 4,798 acres; in rye, 369 acres.
Cotton production: 5,133 bales; average cotton product per acre, 0.42 bale, 597 pounds seed-cotton, or 199 pounds cotton lint.

Hall county is divided by the Chattahoochee river, on the south side of which, at a distance of several miles, is a ridge forming the Atlantic and Gulf divide. The surface of the county north and south of this ridge is hilly and broken. On the north, and lying near the railroad line, is a narrow stratum of magnesian limestone, with associated galena in localities, accompanied by magnesian and talcose slates; but the belt of these is not wide enough to give to the lands any marked difference from those of the other rocks. In the southern part of the county there is a belt of red lands derived from decomposed hornblendic rocks, which also comprise a large part of the lands of the county, though the gray sandy lands are most abundant, being derived from gneisses and mica-schists filled with gold-bearing quartz veins. (For description of soils, see page 34.)

Gold-mining is carried on extensively in the country north of Gainesville. Ten per cent. of the county is too hilly for tillage, and 30 per cent. has been cleared. The crops are corn, wheat, oats, cotton, potatoes, grapes, and fruits. The percentage of county area under tillage is the same as that of Hart (18.8 per cent.), cotton averaging 22.7 acres per square mile, or 18.8 per cent. of tilled lands. Cotton has been planted in this county since 1872, and only with the use of fertilizers.

The average yield of the county per acre is excellent, there being but nine counties in the state with a greater percentage.

ABSTRACT FROM THE REPORT OF DR. M. F. STEPHENSON, OF GAINESVILLE.

Cotton is planted equally on gray sandy and red uplands and on alluvial lowlands, and comprises one-fourth of the crops. The *mulatto* and *red lands* are considered the best, and constitute one-half of the area of the county. The soil has a depth of 2½ inches, with a reddish-brown subsoil and a growth of oak, hickory, walnut, cherry, poplar, and pine. It is easy to till, and is early and well drained, producing half a bale, or 700 pounds of seed-cotton per acre on fresh lands. It is improved by cultivation, yielding the fifth year from 700 to 900 pounds of seed-cotton per acre. The stalk is most productive at a height of 2 feet, and is troubled most by rag-weeds. One-tenth of the land originally under cultivation now lies out, and when taken in again is almost as productive as when fresh, and fully as much so if deep planting is practiced. These lands wash readily, but no serious damage is done.

The *gray sandy lands* are best adapted to cotton culture. They produce from 300 to 700 pounds of seed-cotton when fresh, but only 300 pounds after five years' cultivation. The growth is oak, hickory, dogwood, and poplar. The *bottom lands* have a fine, sandy loam soil from 5 to 12 feet deep, yielding from 400 to 600 pounds of seed-cotton after five years' cultivation.

Under the old system of farming the average yield was of wheat from 7 to 10 bushels per acre; now, under the new, the yield is from 10 to 30, and sometimes 40 to 46 bushels. Of corn cultivated 2½ inches deep without manure the yield ranged from 10 to 15 bushels; now, by turning under green crops in the fall, with lime composted with ashes and muck, the product is from 20 to 60 bushels, with promise of 100 and more. Clover is our main helper. Sheep-raising is being introduced successfully. Our people are slow to adopt modern improvements; only 14 farmers in the whole county have adopted modern systems, and they more than double their crops with the same labor. With 2½ feet of subsoiling they could quadruple their products. With proper tillage we can make 2 bales of cotton per acre, instead of half a bale; 100 bushels of corn instead of 15 bushels, and 50 bushels of wheat instead of 7.

We cling to the old and ancient system of "animalism"—just enough to live on—and let science go. Nine-tenths of our farmers feed all their crops with the same manure, without respect to character of soil or wants of each crop. I have raised 427 bushels of Irish potatoes from one acre, highly manured with ashes, which the year before made only 17 bushels. It is the kind of food, and not the quantity given to the crops, that produces best yields.

Shipments of cotton and other produce are made by railroad.

FORSYTH.

Population: 10,559.—White, 9,072; colored, 1,487.
Area: 250 square miles.—Woodland, all; metamorphic, all.
Tilled lands: 53,042 acres.—Area planted in cotton, 12,121 acres; in corn, 20,324 acres; in wheat, 7,797 acres; in oats, 6,040 acres; in rye, 74 acres.
Cotton production: 5,044 bales; average cotton product per acre, 0.42 bale, 594 pounds seed-cotton, or 198 pounds cotton lint.

The monotony of a rolling metamorphic country is varied in Forsyth county by Sawnee mountain, a low range of hills north of Cummins, which passes at first in an easterly direction, connects with Coal mountain, and turns northward in the northeastern part of the county, forming the water-divide between the Chattahoochee and Etowah

rivers. The highest point of Sawnee mountain is only 400 feet above the surrounding country and 1,968 feet above the sea. The crest of the ridge is sharp and the sides rather steep, a micaceous sandstone (itacolumite) outcropping along the summit. Five per cent. of the county is too hilly and broken for tillage, and one-half of the rest has been cleared. The northern part lies in the gold belt, and its lands are mostly gray sandy and gravelly, with narrow belts of red clays.

In the central part there is a belt of red and mulatto lands 6 or 8 miles wide, from mica-schists and some hornblendic gneisses, while on the south the lands are again gray and gravelly, with large quartz fragments lying on the surface. This also is gold-bearing. One-third of the county area is under tillage, and of this 22 9 is in cotton, which has an average of 48.5 acres per square mile. The soils are described in the following abstract:

ABSTRACT FROM THE REPORT OF H. C. KELLOGG, OF PLEASANT GROVE.

The lands may be classed as follows: *Red or mulatto uplands*, covering three-fourths of the county, with a sandy clay soil from 6 to 18 inches deep and a subsoil mostly of red clay, firm and compact, and which drains easily. These lands are best adapted to corn and wheat, though of late years the culture of cotton has increased 100 per cent., and it now comprises one-third of the crops. The average yield on fresh land, and also on land ten years in cultivation, is 600 pounds per acre, or 800 when manured, 1,485 pounds making 475 pounds of "middling" lint from fresh and 1,425 pounds from old lands, the lint then rating as good middling. The lands are found to produce cotton better when old than when fresh, and hence only 10 per cent. of the lands now lie out, while a few years ago there was 20 per cent. Very little damage is done by washing of the hills. Rag-weed and crab-grass are troublesome.

The *gray sandy and gravelly lands*, covering one-fourth of the county, are found mostly on ridges, and have a light red or yellow subsoil at 6 inches depth. Cotton very seldom runs to weed on this land, but grows to a height of 3 feet, and produces, when fresh and after four years' cultivation, 500 pounds of seed-cotton per acre, the staple rating the same as on red lands. These old lands are also considered best for cotton.

Cotton is shipped, soon after ginning, by wagon, to the railroad, and thence to Atlanta. Rates are 90 cents for 40 miles, and $1 for 50 miles, per bale.

MILTON.

Population: 6,261.—White, 5,484; colored, 777.

Area: 110 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 30,629 acres.—Area planted in cotton, 9,989 acres; in corn, 13,039 acres; in wheat, 4,187 acres; in oats, 3,025 acres; in rye, 113 acres.

Cotton production: 4,490 bales; average cotton product per acre, 0.45 bale, 642 pounds seed-cotton, or 214 pounds cotton lint.

The surface of Milton county is rough and broken, the water-divide between the Chattahoochee and Etowah rivers passing through it. The lands are largely gray sandy and gravelly, with clay subsoils, and their surface is covered with quartz fragments from the many large veins and seams (gold-bearing) that intersect the mica-schists and gneisses. In some localities the rocks are highly garnetiferous, covering the soil with this small rounded material. The county is well timbered with oak, hickory, and pine, and a variety of undergrowth.

Ten per cent. of the area of the county is either too hilly or too swampy for cultivation, and about 40 per cent. has been cleared. The uplands yield 15 bushels of corn per acre when cultivated.

The lands are similar in character, and the methods of culture are the same as in the lower part of Forsyth county, and 43.5 per cent. of the county area is under cultivation; 32.6 per cent. of this is in cotton, the average being 90.8 acres per square mile. The average yield of cotton for the county is excelled but by five counties of the state, due probably in part to the rich alluvial valley lands of the Chattahoochee river on the southern border.

Cotton is hauled by wagon to the railroad, and thence shipped to Atlanta.

CHEROKEE.

Population: 14,325.—White, 12,699; colored, 1,626.

Area: 470 square miles.—Woodland, all; northwestern, 11 square miles; metamorphic, 459 square miles.

Tilled lands: 63,289 acres.—Area planted in cotton, 13,739 acres; in corn, 26,330 acres; in wheat, 10,283 acres; in oats, 5,172 acres; in rye, 416 acres.

Cotton production: 5,615 bales; average cotton product per acre, 0.41 bale, 582 pounds seed-cotton, or 194 pounds cotton lint.

The entire surface of Cherokee county is hilly, 15 per cent. being too broken for cultivation, especially in the northwest and west, where the Pine Log range of mountains passes through the county. On the east the lands are more level, and on the south, along Little river, they are undulating

The lands embrace the usual gray sandy and gravelly and the red clayey varieties common to the region. (See general descriptions, page 32.) A few miles south of Canton small common garnets cover the lands in great abundance.

The surface of the county is well timbered with oaks and hickory, and is comparatively sparsely settled.

The dark gray gravelly lands predominate, especially in the northern part of the county, and are interspersed throughout with small patches of red. On the south of Canton there are a number of narrow belts of red lands derived from hornblendic rocks. The largest of these belts has a width of several miles. Twenty-one per cent. of the county area is under tillage, and 21.7 per cent. of these tilled lands are in cotton, the average being 29.2 acres per square mile; its yield per acre is large.

The following experiment of M. S. Paden, of Woodstock, was reported to the state department of agriculture:

Soil, gray and sandy, with a mulatto subsoil, was cleared about thirty years ago. Original growth, red oak and black-jack, with some chestnut and pine. The land had been lying out since the war, and had grown up in sassafras and young pines. When again cleared and planted the yield of the rows was about 245 pounds of seed-cotton per acre. Those rows having 200 pounds of fertilizers per acre freshly applied yielded from 840 to 1,085 pounds per acre. The application of lime alone gave a yield of 490 pounds per acre. Eight different brands of commercial fertilizers were separately used in this experiment, the result of each being noted.

ABSTRACTS FROM THE REPORTS OF ELIAS C. FIELD, OF CANTON, AND M. S. PADEN, OF WOODSTOCK, NEAR THE COBB COUNTY-LINE.

The lands of the county are: 1. The *red clay* or *mulatto uplands*, considered the best in the county, though comprising but one-fourth of the area with its belts and patches. Corn succeeds better than cotton on this soil, though the latter comprises one-half of the crops. Six hundred pounds of seed-cotton per acre are raised on fresh and 400 pounds on old lands of ten years' cultivation. Three feet is the most productive height of the stalk, and very heavy manuring and topping are practiced to prevent its running to weed in wet weather. The most troublesome weeds are cocklebur and hog-weeds. The cotton rates as good middling. The growth on the uplands is post oak, poplar, hickory, with some buckeye. The soil is 6 inches deep, and has a deep red-clay subsoil, rather free from sand, which bakes very hard when first exposed, but gradually partakes of the nature of the soil. It is quite impervious when undisturbed. The lands formerly worn out are now considered the best cotton lands of the uplands, as they are loose and sandy, and fertilizers can be used to great advantage.

2. The *light sandy bottom lands* are thought by some to be the best cotton lands of the county. They extend along the streams in small patches sometimes for miles, and have a growth of pine, sweet gum, sourwood, and poplar. The depth is but a few inches to a very stiff mulatto subsoil, which is underlaid by sand and gravel at 2 feet. Cotton comprises 25 per cent. of the crops on these lands. They have a productiveness equal at first to the red lands, but wear out more rapidly. In ten years the land produces but 200 pounds per acre without the aid of fertilizers, and as a consequence about one-half of this land now lies out. Sorrel and "poor Joe" are the most troublesome weeds.

3. The *dark sandy second bottoms* of the streams comprise but a small proportion of the lands of the county, and differ from the sandy first bottoms in yielding but 500 pounds of seed-cotton per acre at first and 300 after ten years' cultivation, and in having as troublesome weeds the Spanish needles and smart-weed. One-fourth of this land now lies out, and is injured one-fourth by the washings of the hills. The growth of these bottoms is beech, birch, willow, and sweet and black gums.

Cotton on the low and flat lands is liable to be late and is more subject to being killed by frost than on the uplands, and hence the latter are preferred as cotton lands. In this county the crops are slow in starting, but grow very rapidly through the latter part of May and on until matured. Before the late civil war very little cotton was planted in this county, but by the use of fertilizers it has been brought up to a high standard.

As soon as ready, cotton is shipped by the North Georgia narrow-gauge railroad to Marietta at 40 cents, or to Atlanta for $1 per bale.

BARTOW.

(See "Northwest Georgia"

HARALSON.

Population: 5,974.—White, 5,821; colored, 153.

Area: 330 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 28,225 acres.—Area planted in cotton, 4,860 acres; in corn, 13,048 acres; in wheat, 4,909 acres; in oats, 2,736 acres; in rye, 88 acres.

Cotton production: 2,035 bales; average cotton product per acre, 0.42 bale, 597 pounds seed-cotton, or 199 pounds cotton lint.

The Dug Down mountains of Haralson county form the northern limit of the metamorphic region in this part of the state. Southward from the mountains the surface of the county is well timbered, broken, and hilly, with mostly the dark-gray sandy lands described in the general part, page 32. A red clay belt crosses in a southwesterly course into Carroll county. Seven and one-half per cent. of the surface of the county is said to be too hilly for cultivation, and 3 per cent. is of irreclaimable swamp. The rocks are the usual metamorphic gneisses and mica-schists, filled with gold-bearing quartz seams and veins.

The tilled lands embrace 13.4 per cent. of the county area. Of these 17.2 is in cotton, its average being 14.7 acres per square mile. The yield per acre is more than that of the region or of the state at large.

ABSTRACT FROM THE REPORT OF W. C. M'BRAYER, OF DRAKETOWN.

The cotton lands of the county may be classed as gray uplands, red uplands, and white piny woods soil.

1. The *gray sandy uplands*, with oak and hickory growth, comprise two-thirds of the county area, and are best adapted to corn, wheat, and oats, though 60 per cent. is planted in cotton. The yield is 800 pounds of seed-cotton per acre on fresh lands and from 500 to 700 pounds after five years' cultivation. Rag- and hog-weeds are most troublesome. The lands wash readily after three or four years, but the damage done is not great. Efforts to check it are made by hillside ditching and by rock dams.

2. The *red lands* extend northeast or southwest indefinitely, and are from 3 to 10 miles wide. The growth is hickory, oak, chestnut, poplar, dogwood, buckeye, persimmon, and black gum. In all respects these lands resemble the gray sandy lands already mentioned.

Shipments of cotton are made to Atlanta and Rome.

PAULDING.

Population: 10,887.—White, 9,903; colored, 984.

Area: 340 square miles.—Woodland, all; northwestern, 46 square miles; metamorphic, 294 square miles.

Tilled lands: 52,654 acres.—Area planted in cotton, 16,158 acres; in corn, 21,953 acres; in wheat, 6,372 acres; in oats, 6,101 acres; in rye, 116 acres.

Cotton production: 7,352 bales; average cotton product per acre, 0.46 bale, 648 pounds seed-cotton, or 216 pounds cotton lint.

The northern part of Paulding county, perhaps comprising one-half of its entire area, is very hilly and broken. The Dug Down mountain chain covers a large portion of it. A water-divide also comes in from the Lost and Kennesaw mountain range on the east and turns southwest and south into Carroll county. The streams are thrown

into three directions by these ridges, those on the north emptying into the Etowah river, those on the southeast into the Chattahoochee, and the rest into the Tallapoosa, on the southwest. On the south the country is rolling but nearly all tillable. The entire county is well timbered, and about 53 per cent. is said to be cleared, 8 per cent. being too mountainous or rocky for tillage. Gold and copper ores and asbestus are found in the county. A small area of the county on the north is covered by the conglomerates and sandstones of the northwestern region. Its lands are sandy, and the section is but little in cultivation, except along the larger streams.

Over the rest of the county southward the red clays and gray sandy soils are found intermingled throughout, but all have yellow or red clay subsoils, and are similar to other lands of the region (see pages 32, 33). The red lands form one or two narrow belts across the county, agreeing in course with their accompanying hornblendic rocks, viz, southwest and northeast.

In going from Dallas to Draketown, on the southwest, red lands are found to predominate for the first 4 miles; then a belt of 2 miles of gray sandy lands is crossed, followed by three-fourths of a mile of red lands again. Thus they alternate through the county. On the southeast they alternate in belts of from one-half mile to one mile in width. Granite outcrops are abundant in this southeast section. One area 4 miles south of Dallas has a width of 4 miles and a growth of long-leaf pine. Tilled lands comprise 24.2 per cent. of the county area. Of these 30.7 are in cotton, with an average of 47.5 acres per square mile. The crops of the county are cotton, corn, wheat, oats, and potatoes.

Cotton is one of the principal crops of the county, and with the aid of fertilizers the average yield per acre is high. But four counties of the state are above it in this respect.

ABSTRACT FROM THE REPORT OF J. R. PREWETT, OF DALLAS.

The gray sandy and the red clay lands are chiefly devoted to cotton culture. The *gray sandy* lands comprise three-fifths of the area of the county, and has a depth of 4 inches, a yellow-clay subsoil, and a growth of post, white, and red oaks, hickory, pine, and some poplar. Cotton, which comprises one-half of the crops, grows to a height of from 3½ to 4 feet, and yields 900 pounds of seed-cotton per acre on fresh land. Ten years' cultivation (unmanured) reduces this yield to 450 pounds, and 1,545 pounds are then required to make 475 pounds of lint. Rag-weed gives cotton crops most trouble. One-fifteenth of these lands now lies out, and with ten or fifteen years' rest yield as well as at first. Both uplands and valleys are injured to some extent by the washing away of the soil and the formation of gullies. Some farmers make efforts to check the damage, and with good success.

The *red lands* have a growth of oak and hickory and an orange-red sandy clay loam soil 6 inches in depth, underlaid by red clay. The soil is early, warm, well drained, and difficult to till in wet seasons. Cotton comprises one-third of the crops, grows to a height of 3½ feet, and yields 600 pounds of seed-cotton per acre on fresh land. Ten years' cultivation (unmanured) reduces this yield to 300 pounds. Two per cent. of this land now lies out, and unless fertilized does not yield well again. The uplands do not wash much.

Shipments of cotton are made to the various towns along the railroad, by wagon, at 40 cents per 100 pounds.

COBB.

Population: 20,748.—White, 14,734; colored, 6,014.

Area: 400 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 88,578 acres.—Area planted in cotton, 27,250 acres; in corn, 29,699 acres; in wheat, 10,147 acres; in oats, 6,789 acres; in rye, 85 acres.

Cotton production: 13,092 bales; average cotton product per acre, 0.48 bale, 684 pounds seed-cotton, or 228 pounds cotton lint.

The surface of Cobb county is rolling and hilly, with also a number of isolated and prominent low mountains. A dividing ridge, or water-divide, passes through the county, Sweat mountain on the northeast, Black Jack and Kennesaw in the center, and Lost mountain on the west, being prominent points of the ridge, without which it would hardly be noticed, on account of the slight elevation.

The first two of these mountains are composed of quartz-rock almost exclusively, and are situated on the southeastern side of a broad belt of deep red lands derived chiefly from hornblendic rocks. (See analysis, page 35.) Kennesaw and Lost mountains are composed of hornblendic gneisses and schists, and are in the northern part of the red belt as it passes westward out of the county. Kennesaw is the most prominent of these mountains, standing out so high above the rolling country around as to be seen from a great distance. All of these mountains have narrow summits and abrupt sides, their trends following the course of the red belt as marked on the map. On the north of this water-divide are Allatoona and Noonday creeks, flowing northward into the Etowah river; on the south the drainage of the streams is into the Chattahoochee river. On the north, at the Cherokee county-line, the red belt has a width of only 3 or 4 miles, which increases to 8 or 10 miles after it reaches the middle of the county and turns westward. The soil is deep and usually quite free from gravel. In the northwestern corner of the county the country is rolling, with a gray sandy soil full of quartz gravel, overlying a red and yellow clay subsoil at depths of from 6 to 12 inches. Some red land is found in this section also. This part of the county is gold-bearing.

On the south of the red belt the soils are very changeable. A large granite area lies between Marietta and Powder Springs on the southwest, the soils of which are gray and deep sandy. Associated with it are gray gneisses, with biotite mica and mica-schists. This last, with quartz seams, covers nearly all the eastern and southeastern portions of the county, which is rolling and hilly, the valleys between the hills being chiefly cultivated. The soil is usually gray and sandy, though occasional red spots of an outcropping syenite or decomposed hornblendic rock appear. On cultivation, the thin sandy soil becomes mixed with the clay subsoil, and a reddish or mulatto soil is the result.

The river valleys are not very wide, unless at some turn of the river where the current has been so long thrown against the opposite bank as to wear it away and leave an alluvial deposit in the bend. Some of these are subject to overflow, and all are very productive. The county is well timbered, and 34.6 per cent. of its area is under cultivation. Of the tilled lands 30.8 per cent. is in cotton, the average of that crop being 68.1 acres per square mile. Cobb is one of the two counties of the state having the highest average yield of cotton per acre, almost half a bale.

Shipments of cotton are made from Marietta to Atlanta by railroad.

J. T. Lindley, of Powder Springs, reports to the department of agriculture the results of an experiment on the dark mulatto land that has been under cultivation thirty-three years:

Fertilizers occasionally used; original growth, oak, hickory, and chestnut; yield without fertilizers, 700 pounds of seed-cotton; yield with 200 pounds commercial fertilizers from 1,000 to 1,470 pounds of seed-cotton. Another experiment with 300 pounds of fertilizers yielded 2,650 pounds of seed-cotton.

ABSTRACTS FROM THE REPORTS OF H. M. HAMMETT, OF MARIETTA, AND JAMES ROSWELL KING, OF ROSWELL.

The seasons in this county being very short, it is found necessary to use fertilizers to hasten the maturity of cotton crops. A *sandy loamy soil* is best adapted to the cultivation of cotton, comprising two-thirds of the lands of the county, and having a growth of pine, post, red, and white oaks, and hickory, poplar, and beech, a depth of 10 inches, and a grayish-red clay subsoil. The soil contains much quartz gravel. It is late, ill drained, and easy to till in wet but difficult in dry seasons, and is best adapted to corn; but if fertilized, cotton grows best. Cotton forms one-third of the crops, grows to a height of from 2 to 3 feet, and produces from 500 to 700 pounds per acre on fresh lands. Three years' cultivation reduces the yield to 300 pounds. The plant is inclined to run to weed when planted too close on rich land in wet weather, or when it is fertilized by strong stable manure. The usual methods of restraining it are topping and the use of commercial fertilizers. The staple rates as low middling, but the fiber is shorter on old lands. Rag-weeds and crab-grass are most troublesome on these lands, about 10 per cent. of which now lie out, but after a rest they produce as well as at first. They wash readily, doing serious damage in some places, but improving the valleys. Hillside ditching is employed to prevent this, and with satisfactory results.

The *red clay lands*, interspersed with the gray, cover about one-fourth of the county, and have a heavier subsoil at a depth of from 5 to 10 inches, containing flinty angular pebbles. The growth is post and red oaks, hickory, and pine—more hickory than on the sandy lands. It is easily tilled in dry weather, is cold and ill drained, and is best adapted to small grain, though cotton comprises about half the crops. The height usually attained by cotton on this soil is 3 feet, and it yields from 250 to 500 pounds of seed-cotton per acre, 1,545 pounds being required for 475 pounds of lint, rating as low middling. Three years' cultivation reduces this yield to 150 or 250 pounds of seed-cotton. Very little of this land now lies out, and it does not as readily wash as the sandy land.

FULTON.

Population: 49,137.—White, 28,295; colored, 20,842.

Area: 200 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 38,735 acres.—Area planted in cotton, 10,038 acres; in corn, 13,988 acres; in wheat, 2,836 acres; in oats, 3,069 acres; in rye, 24 acres.

Cotton production: 4,285 bales; average cotton product per acre, 0.43 bale, 609 pounds seed-cotton, or 203 pounds cotton lint.

The surface of Fulton county is rolling and well timbered, and mostly suitable for tillage, 2½ per cent. being said to be too broken.

The Atlantic and Gulf water-divide, entering the county from the east, turns southward at Atlanta to East Point and into Clayton county. The altitude of Atlanta is 1,050 feet above sea-level and 288 feet above the Chattahoochee river where crossed by the Western and Atlantic railroad.

The country north of Atlanta is covered with a gray sandy, gravelly soil, with large fragments of quartz-rock lying upon the surface and thickly deposited in many places, derived from somewhat gold-bearing quartz seams in the mica-schists and gneisses which form these lands. On the extreme north, near the river, there are large areas of gray lands, and these are also found on the west of the city toward the river.

On the southwest there is a large granitic area, with many abrupt and rounded hills and huge masses of granite, forming a rough and broken country. The rocks are coarsely crystalline, and are accompanied in some places by hornblendic material. The lands are gray, sandy, and gravelly, the material being usually coarse; the subsoils are yellow and red clays, which sometimes are exposed by denudation. Narrow belts of red lands also accompany the hornblendic outcrops of the section. The country embraced by the granite is bounded by Sandy creek on the north, while the Central railroad lies a little to the east of it, extends into Campbell county on the south, and on the west is separated from the river by a narrow belt of itacolumite sandstone and mica-schists.

The southeastern part of the county has a great variety of soils, derived from mica-schists, hornblende, gray gneisses, and steatites (soapstone). The red clay soils seem to predominate, and when sandy soils exist the red-clay subsoil approaches frequently so near the surface as to be turned up by the plow, forming with the gray soil a red mulatto land.

A prominent ridge of soapstone or saponite, with asbestus and serpentine, begins 3 miles south of Atlanta, and, passing along the south side of South river near the county-line, enters De Kalb county. The valleys formed in the bends of the rivers are in some places quite broad, and have a rich and highly productive sandy loam soil. They are, however, devoted to corn, as cotton is too liable to injury from early frosts and is too late in maturing. The stalk also is inclined to run to weed. The lands under tillage comprise 30.3 per cent. of the county area, cotton being the chief crop, its acreage embracing 25.9 per cent. of the tilled lands, and averaging 50.2 acres per square mile. The average yield is comparatively high, the county ranking ninth in the state in its cotton product per acre.

The city of Atlanta is the market for the cotton product of many of the counties, a large cotton factory using much of that brought in; but the greater part, after being reduced in bulk at the Morse steam cotton-compress, is shipped to northern or European markets over the many railroad lines that center in the city. The rates of freight are per 100 pounds.

The following experimental results were reported by Colonel I. W. Avery, of Atlanta, to the department of agriculture:

The soil was an ordinary clay land with a clay subsoil, that had been cleared for fifty years and manured the previous year. The yield in 1879 was 500 pounds of seed-cotton per acre without fresh manures: with 200 pounds of commercial fertilizers of various brands, and applied alone and in composts, on twenty-five experimental plats, the yield varied from 700 to 1,380 pounds of seed-cotton per acre, eighteen of the plats yielding over 1,000 pounds each per acre.

ABSTRACTS FROM THE REPORTS OF J. C. TUCKER, OF BEN. HILL P. O., AND THOMAS MOORE, OF BOLTONVILLE.

The *uplands*, with their gray and red soils, are the cotton lands of the county, one-third of the area under cultivation being devoted to that crop. The growth of the uplands is poplar, hickory, a variety of oaks, pine, sweet and black gums, and occasionally ash and dogwood. The soil has usually a depth of 6 inches over a red and sometimes yellow subsoil, which bakes in the sun and wind. The land is early, warm, well drained, and easy to till, producing crops of corn, cotton, wheat, oats, potatoes, and sorghum, but is adapted to corn, cotton, and oats.

Cotton grows to a height of 2 feet in dry and 3 feet in wet seasons, producing 600 pounds of seed-cotton on fresh lands. After four years' cultivation this yield is reduced to 400 pounds, and in ten years to 300 pounds. The staple also is shorter and the seed lighter.

About one-half of this land now lies out and is grown up in sedge-grass or in old-field pines or "pine orchards". The latter do well when taken in again, but lands covered with sedge-grass remain poor for a year or two. Most of the fields are cut up by the washings of the land. Hillside ditching, and also deep plowing, prevent this damage to a great extent. Crab-grass is the chief enemy to crops on these uplands. The rag-weed is very common.

DE KALB.

Population: 14,497.—White, 9,954; colored, 4,543.

Area: 280 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 60,023 acres.—Area planted in cotton, 19,318 acres; in corn, 21,034 acres; in wheat, 5,866 acres; in oats, 5,974 acres; in rye, 36 acres.

Cotton production: 8,008 bales; average cotton product per acre, 0.41 bale, 591 pounds seed-cotton, or 197 pounds cotton lint.

The surface of De Kalb county has the usual undulating character of the metamorphic region. Stone mountain, a bald mass of granite, is the most prominent point in the county, and the village near its foot, Stone Mountain, formerly had the name of New Gibraltar. These granites extend east and south over the rest of the county, covering it with gray sandy and gravelly soils and yellow clay subsoils. Over the rest of the county are found the usual red clay and gray sandy lands, with the intermediate grades of mulatto.

A red belt, and the only one of any extent, passes through the county, via Decatur, from Gwinnett, into Fulton county, south of Atlanta, and has a general width of about 5 miles. North of this the lands are gray and gravelly, with fragments of quartz on the surface, and are slightly gold-bearing. On the south of the red belt the county is also gray sandy until the ridge of soapstone or saponite is reached in the southern portion. This ridge enters from Fulton county with an easterly trend, but is not continuous. Asbestus (short fiber) is associated with the rock. The lands from these rocks are rather red, but the area is not very great, and the magnesian character of the material, from decomposition, is lost in the soil by its large intermixture with other constituents. Seventy-five per cent. of the county is said to have its original timber growth.

A little more than one-third of the county area is under cultivation. Cotton acreage is less than that of corn, but comprises 32.2 per cent. of the tilled lands, and averages 69 acres per square mile. Fertilizers are used in its culture, and the yield for the county is very good. There are but fourteen counties of the state having a greater average yield.

ABSTRACTS FROM THE REPORTS OF T. A. RAGSDALE, OF LITHONIA, AND T. J. FLAKE, OF PANTHERSVILLE.

The soils may be classed as bottom and upland gray, red, and mulatto lands. There is but little bottom land in the county, and it is seldom planted in cotton, as that crop runs too much to weed and matures too late; corn and oats alone are planted. The uplands are very much mixed. The mulatto soil is best for all crops, the red next; but the gray is easier cultivated, and the increase in the number of acres to both stock and hands renders the gray soil preferable for cotton. One hand, with a mule, can cultivate so much more of the gray lands than of the red or mulatto that the result is a greater total number of bales.

The *gray upland soils* cover about two-thirds of the county. They are usually gravelly and fine sandy to a depth of 3 or 4 inches, and have a stiff clay subsoil. These lands are moderately well drained and easy to till. The chief crops of the county are corn, cotton, wheat, oats, and sweet potatoes, but this land is best adapted to cotton and oats. The former grows to a height of 30 inches, producing from 700 to 800 pounds of seed-cotton per acre when fresh, or from 300 to 400 pounds after six years' cultivation. Crab-grass and "poor Joe" are most troublesome on gray soils. One-fifth of these lands now lie out, and when taken in again yield about 500 pounds of seed-cotton per acre. They suffer serious damage by washing on slopes, but the valleys are not much injured by it. Hillside ditching is practiced to obviate the damage.

The *red uplands* are not continuous, and are the wheat lands of the county. They have a growth of oak and hickory principally, with some chestnut, poplar, black-jack, ash, etc. The soil is a stiff red clay, which, when exposed to the sun, bakes and becomes very hard, and plowing is then impossible. It has a depth of 4 or 5 inches, and contains hard, rounded, and angular rocks. When well drained it is earlier than the gray soil. Cotton grows to a height of from 30 to 48 inches, producing 800 pounds of seed-cotton per acre when fresh and 600 pounds after six years' cultivation. About 10 per cent. of this land now lies out, but after a rest of two or three years it is equal to fresh land.

"*Ginger-bread*" *mulatto soils* cover about one-sixth of the county, interspersed with the red and the gray. The growth is oak, hickory, dogwood, poplar, etc. Its depth is 5 or 6 inches over a heavier subsoil, which, when broken up, becomes much like the surface soil. It is easier cultivated than the red, and resembles it in productiveness. The *bottom lands* are not devoted to cotton, as it usually runs to weed too readily and matures too late. These lands are therefore given up to corn and oats. Near the creeks and rivers the crop is most liable to be killed earlier by fall frosts than a few miles away, on the ridges, and it is also later in growing off in the spring.

Fifteen hundred and forty pounds of seed-cotton make 475 pounds of lint, which, when clean, rates as middling. Shipments are made to Atlanta by railroad or by wagons.

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The *second bottoms* of the creeks and rivers cover about one-sixth of the county, and have a fine sandy clay loam soil 2 feet in depth and a dark red-clay subsoil or white pipe-clay. The growth is chestnut and gum. The soil is difficult to till in wet seasons, but easy in dry. Cotton comprises one-sixth of the crops on these bottoms, grows to a height of 4 feet, and yields from 800 to 1,000 pounds of seed-cotton. Cockleburs and rag-weeds are most troublesome. Very little of this land now lies turned out.

The *bottom lands* on creeks and rivers have a growth of maple, poplar, walnut, and beech, and a clay loam soil 3 feet in depth, underlaid by a white pipe-clay. The soil is difficult to till, and only a very small percentage of cotton is planted on it, although it sometimes yields as much as 1,200 pounds of seed-cotton per acre the first year; but 600 or 800 pounds is the yield after the second year. The staple rates the very highest. Rag-weeds are most troublesome.

Shipments are made to Athens by wagon, and to Savannah by railroad.

MADISON.

Population: 7,978.—White, 5,392; colored, 2,586.

Area: 300 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 51,716 acres.—Area planted in cotton, 13,029 acres; in corn, 14,471 acres; in wheat, 6,168 acres; in oats, 4,631 acres; in rye, 28 acres.

Cotton production: 4,918 bales; average cotton product per acre, 0.38 bale, 537 pounds seed-cotton, or 179 pounds cotton lint.

The surface of Madison county is hilly and broken and well timbered. A north and south dividing ridge on the west throws nearly all of the waters eastward into the several forks of Broad river. The lands are nearly all gray or gravelly, with patches of mulatto here and there, and are derived mostly from gray biotite gneisses and mica-schists. Five per cent. of the county is said to be too hilly for cultivation, and 1 per cent. too swampy.

On the northwest, near the Banks county-line, is a belt of red lands from hornblendic gneiss, and on the east occurs an exposure of soapstone rocks.

The bottom lands, while rich, are not very extensive, and are chiefly devoted to corn. The lands under cultivation comprise 26.9 per cent. of the county area. Of these lands, 25.2 per cent. are in cotton, its average being 43.4 acres per square mile. The average yield per acre is not as great as in some of the adjoining counties; it is, however, over the "third of a bale per acre" rule. Fertilizers are used extensively, and an instance of the results that might be expected from them when properly applied is shown.

In the experimental report of B. F. O'Kelley, of this county, both the red and the gray lands were used:

1. Dark red soil of a yellow, loose nature and clear of rocks; had been cleared for about fifty years and grown up in old-field pines; recleared in 1876 and planted in sorghum, corn, and wheat; no fertilizers used. Original growth, oak, hickory, dogwood, and pine. In 1879 it yielded without fertilizers 390 pounds of seed-cotton per acre; with 200 pounds of commercial fertilizers the yield was from 1,020 to 1,270 pounds per acre.

2. Light sandy soil with gray subsoil; cleared twenty years, and no fertilizers ever applied. Original growth same as No. 1. Yield 490 pounds of seed-cotton without fertilizers and 930 pounds with 200 pounds of fertilizers. The season of 1879 was dry.

ABSTRACT FROM THE REPORT OF R. M. MERONEY, OF DANIELSVILLE.

The lands of the county may be classed as gray sandy, comprising one-half of the area; mulatto, comprising one-fourth; and gray gravelly, nearly the same amount. The *gray sandy soils*, with gravelly gray subsoils at a depth of 2 inches, have a growth of pine, oaks, hickory, and black-jack. The soil is easily cultivated, is early, warm, and well drained, and is best adapted to cotton, which comprises about one-half of the crops. Cotton grows to a height of from 18 to 40 inches, and yields 600 or 700 pounds of seed-cotton per acre on fresh land. After five years' cultivation this yield is only from 200 to 400 pounds, 1,425 pounds from fresh and 1,485 pounds from old land making 475 pounds of middling lint. One-fourth of the soil now lies out, and when taken in again produces as well as ever for a few years, and when fertilized holds its own afterward. The lands are much injured by washing, and valleys are damaged 10 per cent. Some efforts have been made to check it.

The *red or mulatto lands* are considered the best for grain, though one-half of the crops consists of cotton. The sandy surface is only 1½ or 3 inches deep. The subsoil is gravelly and somewhat sandy, and the growth is pine, black, red, Spanish, black-jack, and post oaks, and hickory. These lands are inclined to bake hard in dry weather. Cotton grows from 2 to 4 feet high (most productive at 2½), and yields from 500 to 700 pounds of seed-cotton per acre on fresh land. The stalk runs to weed with deep cultivation, to prevent which topping and shallow cultivation are resorted to. After five years' cultivation the yield is only from 300 to 400 pounds, and, while the staple is about the same, a little more seed-cotton is required to make 475 pounds of lint. The crops are troubled most with hog-weed and crab-grass. About one-fourth of this land now lies out.

The *gravelly soils*, with coarse gravelly subsoils at 2 inches depth, comprise about one-fourth of the lands of this county, and are not considered well adapted to anything. Very little cotton is planted on them, as its yield is only from 150 to 200 pounds of seed-cotton per acre, and the stalk grows to a height of only 10 or 15 inches on fresh land. Five years' cultivation reduces this yield to 50 or 100 pounds of seed-cotton per acre. The crop is much troubled with poverty-weed and crab-grass. One-half of this land now lies out, and is worthless afterward. It washes badly, and no efforts have been made to reclaim it.

This latitude is rather too high for cotton cultivation, and the seasons are rather short. Cotton is frequently killed in the spring or injured in the fall by frost. In the latter case a yellow cotton is produced, and occasionally the bolls are prevented from opening.

Shipments of cotton are made to Athens at $1 per bale.

ELBERT.

Population: 12,957.—White, 6,085; colored, 6,872.

Area: 440 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 79,406 acres.—Area planted in cotton, 25,833 acres; in corn, 20,369 acres; in wheat, 7,688 acres; in oats, 5,552 acres; in rye, 50 acres.

Cotton production: 8,826 bales; average cotton product per acre, 0.34 bale, 486 pounds seed-cotton, or 162 pounds cotton lint.

of 3 feet, and yields from 800 to 1,000 pounds of seed-cotton per acre. Crab-grass gives the most trouble to cotton crops; weeds follow grain crops. Lands turned out thirty years ago and cleared now do better in cotton for three years than the original forest lands. These uplands are much injured by washing and gullying, and the valleys are often greatly injured. Horizontalizing and hillside ditching are very successful in checking the damage.

The *red uplands*, comprising one-third of the lands of the county, have the same growth as the gray sandy, and are usually rolling and hilly. The soil is a red or mixed clay loam, 10 inches in depth, with a tough yellow-clay subsoil, which pulverizes quickly and changes color on being exposed. It is early when well drained, rather difficult to till, and is best adapted to grain, though cotton comprises one-half the crops. Cotton grows to a greater height on this land than on the gray sandy, and runs to weed in wet weather unless fertilizers are used, which prevent it and favor bolling. In other respects it resembles the gray sandy. In some localities a great deal of this land lies turned out, and when reclaimed it does not produce as well as the sandy lands. The uplands wash readily, causing serious injury to the valleys.

The *bottom lands* differ in character, some being stiff and others a dark sandy loam. The soils are about 2 feet deep, and are underlaid by a stiff pipe-clay or gravel. They are hard and cloddy in dry seasons, and are best adapted to corn. They are more or less liable to overflow, and but little cotton is planted on them. The plant grows usually 5 or 6 feet high, and runs to weed when the rows are close together, or in wet weather. The yield is from 1,000 to 1,500 pounds of seed-cotton per acre.

Shipments are made to Augusta, by railroad, at $2 per bale.

CLARKE.

Population: 11,702.—White, 5,313; colored, 6,389.

Area: 180 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 23,337 acres.—Area planted in cotton, 8,020 acres; in corn, 7,394 acres; in wheat, 1,387 acres; in oats, 1,755 acres; in rye, 36 acres.

Cotton production: 3,310 bales; average cotton product per acre, 0.41 bale, 588 pounds seed-cotton, or 196 pounds cotton lint.

Through the middle and western sections of Clarke county flow the several forks of the Oconee river, separated on the east from the tributaries of the Broad river by a low ridge running north and south, which is also a part of the main Oconee and Savannah water-divide. The surface of the county is very hilly and broken, being deeply cut by the various streams. The county was once heavily timbered, but it has been estimated that 78 per cent. of the original forest has been removed. The lands of the county present the usual variety of the red clay and gray sandy soils, more or less gravelly, that are found over the entire metamorphic region, and are underlaid by clay subsoils. They occur very much intermixed, but, as in other counties, there are large areas in which one is predominant.

There are two belts of red (hornblendic) lands that extend across the county, and another red area covers the southern portion. Otherwise the lands are chiefly gray and sandy. They are described in the accompanying abstract. (See also analysis on page 33.) The bottom lands are very narrow, the uplands often approaching to the water's edge and forming high bluffs.

A little more than one-fifth (20.3 per cent.) of the county area is under cultivation. Cotton is the chief crop, its acreage comprising 34.4 per cent. of tilled land and averaging 44.6 acres per square mile. The product per acre is comparatively high. Athens is the chief market for the county.

The following experiment was reported to the department of agriculture by Thomas W. Gean, of Athens:

Soil thin, with red-clay subsoil; has been cleared fifty years; part of the time an old field. Original growth, post oak, chestnut, and short-leaf pine. No manures previously used. Yield, without fertilizers, about 425 pounds of seed-cotton per acre. With over 200 pounds of fertilizers the yield varied from 989 to 1,130 pounds per acre.

EXPERIMENTAL FARM OF THE UNIVERSITY OF GEORGIA.—Thin gray soil, with red-clay subsoil; not cultivated for thirty years. Original growth, pine and oak. Yield of non-fertilized rows averages 294 pounds; with 200 pounds of various fertilizers the yield varies from 534 to 1,193 pounds of seed-cotton per acre.

ABSTRACT FROM THE REPORT OF PROFESSOR D. C. BARROW, JR., OF THE UNIVERSITY OF GEORGIA, ATHENS.

The lands may be classed as red clays, gray sandy, mulatto, and alluvial bottom soils. The *red clay lands* cover about 65 per cent. of the county area, and extend chiefly in two belts across the county, each about 6 miles wide. The dark red soil has a depth of about 18 inches, with a tough red-clay subsoil, which is excellent for bricks. The soil is fine grained and compact, retaining moisture for a long time, having little sand in its composition. It is very durable, resisting both weathering influences and the taking up of its riches by the plants, and produces crops for a number of years with very little decrease in yield. Its growth is red, Spanish, black, and white oaks, chestnut, pine, hickory, dogwood, and some walnut. The soil is cold and naturally well drained, and is tolerably easy to till in wet seasons. It is best adapted to corn, clover, and wheat, though cotton forms 60 per cent. of the crops. Fresh lands produce from 900 to 1,000 pounds of seed-cotton, and this yield continues for a number of years without any apparent diminution. About 1,545 pounds of seed-cotton are required to make 475 pounds of lint, the staple rating as good middling. The lands are not troubled so much by weeds as by crab-grass. They also have a tendency to wash, and on steep hillsides are much damaged; the valleys are also injured by these washings, especially on small streams. Hillside ditching is practiced with good success in checking the damage.

The *gray sandy lands*, which form a belt 3 miles wide in the middle of the county, comprise 30 per cent. of the lands. The soil is gray and more or less sandy, 16 inches deep, and is underlaid by light yellowish or reddish clay, much less tough than that of the red lands and much less retentive of moisture. It is not as durable as the red lands, is generous in giving up its plant-food, and is more readily washed off by rains than is the red. It also decreases in productiveness more readily. The growth is white, red, Spanish, and post oaks, hickory, pine, and chestnut, this last being more abundant than on red lands. Whenever it is possible, farmers use chestnut rails for fencing purposes, and gray lands are often marked by chestnut fences. These lands are best adapted to cotton and oats, 75 per cent. of the former being planted. The yield is from 1,000 to 1,200 pounds of seed-cotton per acre. While the soil is not so durable as the red land, it recuperates more readily and produces very well for a few years after a rest.

The *bottom lands*, comprising 5 per cent. of the lands of the county, are variable in width, and are never very wide. The growth is birch, hickory, pine, oak, walnut, and frequently considerable white oak. The soil is a dark alluvial loam, sometimes underlaid by a tough pipe-clay, white or bluish in color. The land is best adapted to corn, 10 per cent. only of cotton being planted. Cocklebur and rag-weeds are most troublesome.

OCONEE.

Population: 6,351.—White, 3,327; colored, 3,024.

Area: 160 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 34,223 acres.—Area planted in cotton, 12,303 acres; in corn, 9,930 acres; in wheat, 2,136 acres; in oats, 2,215 acres; in rye, 29 acres.

Cotton production: 4,257 bales; average cotton product per acre, 0.35 bale, 492 pounds seed-cotton, or 164 pounds cotton lint.

Oconee county embraces a long and narrow area between Barber creek and the Oconee river on one side and the Appalachee river on the west. The surface is hilly. A high dividing ridge passes longitudinally through the county, the streams flowing in either direction being very short.

The southern portion of the county is covered with gray sandy lands, which extend to within 3 miles of Watkinsville, on the Union Point road; the rocks are micaceous in character, with garnets and feldspar.

The red lands form a belt across the county from the upper portion of Clarke southward into Morgan county. Watkinsville lies within this belt, the lands extending 1½ miles west and 3 miles south. Hornblendic gneiss forms the prominent rock on the eastern and biotite gneiss on the western half of the belt. Gray lands cover the extreme northwestern section.

The subsoils of all of the lands are mostly yellow and red clays. The character of the soils and methods of cotton culture are similar to those of Clarke county. The timber growth is chiefly red and post oaks, hickory, and short-leaf pine, and it is estimated that 58 per cent. of the growth has been cut away. One-third of the county area is under cultivation, and of this 36 per cent. is in cotton, the chief crop averaging 76.9 acres per square mile. The average product per acre is much less than that of Clarke county, though greater than for the region or state at large.

Shipments are made by wagons to Athens, where most of the cotton is sold.

WALTON.

Population: 15,622.—White, 9,321; colored, 6,301.

Area: 400 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 82,628 acres.—Area planted in cotton, 31,797 acres; in corn, 26,769 acres; in wheat, 9,418 acres; in oats, 6,454; in rye, 97 acres.

Cotton production: 12,534 bales; average cotton product per acre, 0.39 bale, 561 pounds seed-cotton, or 187 pounds cotton lint.

Walton county is largely covered with red clay and mulatto lands. This is especially the case in the middle of the county, where the belt is very wide and extends in every direction from Monroe.

Narrow areas of gray sandy lands are found on both sides of this red section, and in the extreme west appear the granites of the large central region. The difference between the gray sandy and the granitic lands is so slight that they might very well be classed together. The gneisses also are granitic in character, and black mica enters largely into the composition of both. The subsoils are very generally the usual red and yellow clays of the metamorphic region.

The surface of the country is hilly and broken, 1½ per cent. being too much so for successful tillage. There are two prominent and isolated points in the county, viz, Alcova and Jack's mountains, the former having an elevation of 1,088 feet above the sea, or about 200 feet above Social Circle. They are formed of sandstone or quartzites, and have rounded summits.

Thirteen per cent. of the county area is reported to be of irreclaimable swamp. Over half of the original timber has been cleared away. The lands under cultivation embrace 32.3 per cent. of the county area. Cotton is the chief crop, its acreage having an average of 79.5 acres per square mile, or 38.5 per cent. of the tilled lands. In product per acre the county ranks well among the counties of the state.

ABSTRACT FROM THE REPORT OF R. H. CANNON, OF WALNUT GROVE.

The uplands alone are planted in cotton, and may be classed as light gray and red lands. The *gray sandy lands* cover about 80 per cent. of the county, and have a growth of pine, oak, hickory, chestnut, and dogwood. The soil is 3½ inches deep; the subsoil is a buff-colored clay, unproductive when not mixed with the soils. The crops of the county are cotton, corn, wheat, potatoes, and oats. Cotton comprises half of these crops, and yields 600 pounds in the seed per acre on fresh gray lands. Cultivation of five years reduces the yield to 450 pounds, and 1,545 pounds make 475 of lint, which is hardly as good as that from fresh land. Cotton grows from 30 to 45 inches high, and is most troubled by rag-weeds. One-half the land now lies turned out, and, if not washed, is, after resting, as good as the original. Hillside ditching and horizontalizing prevent this washing, but some of the uplands are already much injured. The valleys do not suffer.

The *red lands* comprise 20 per cent. of the tillable lands, and have a growth of pine, oak, hickory, chestnut, dogwood, and gum. The subsoil of these lands is hard and stiff, and is inclined to bake when exposed to the sun. Cotton comprises half the crops, grows 36 to 50 inches high, and yields as on the sandy lands.

Cotton was first planted in this county about the year 1820, but for several years was raised only in limited quantity. About the year 1830 the area devoted to cotton began to increase, and has continued to increase ever since, the largest crop being that of the present year. Commercial fertilizers were first used here in 1866.

Cotton is sold to local buyers at the nearest railroad station, and thence it is shipped to Augusta, Atlanta, or Savannah.

ROCKDALE.

Population: 6,838.—White, 4,149; colored, 2,689.
Area: 120 square miles.—Woodland, all; metamorphic, all.
Tilled lands: 33,529 acres.—Area planted in cotton, 14,448 acres; in corn, 9,951 acres; in wheat, 3,268 acres; in oats, 2,401 acres; in rye, 25 acres.
Cotton production: 4,385 bales; average cotton product per acre, 0.30 bale, 432 pounds seed-cotton, or 144 pounds cotton lint.

Rockdale is covered almost entirely by granite rocks (in bowlders or flat rock) and granitic soils (see general part, page 35). In the extreme eastern part gray sandy soils, derived from gneisses, generally prevail.

The surface of the county is rolling and broken, with an elevation of a little over 900 feet above the sea. It is estimated that at least 4½ per cent. of the lands are too rocky for cultivation, and that 65 per cent. of what was once well timbered have already been cleared.

The crops of the county are cotton, corn, wheat, oats, rye, pease, and potatoes, with fruits, viz, peaches, apples, pears, grapes, etc. Tilled lands comprise 43.7 per cent. of the county area. Cotton has by far the greatest acreage, its average being 120.4 acres per square mile, or 43.1 per cent. of the tilled land. In the former regard it ranks as sixth in the state, but in percentage of tilled land many counties are above it. Its product per acre is low.

ABSTRACT FROM THE REPORT OF W. L. PEEK, OF CONYERS.

The soils may be classed as sandy, with red subsoil; red, with stiff clay subsoil; and sandy, with yellow sandy subsoil. The *gray sandy soils*, with red subsoils, cover half of the county, and are the chief cotton lands. They extend 40 miles east and west and 15 north and south, and have a growth of hickory, red and post oak, pine, and chestnut. The soil is only from 1 inch to 3 inches deep, and is underlaid by rock at from 1 foot to 2 feet. Twenty per cent. of the lands once under cultivation now lie out. They wash readily, doing serious damage occasionally. Cotton grows to a height of one-half to 3 feet, yielding on fresh land from 500 to 1,000 pounds of seed-cotton per acre, the lint rating as middling. Cultivation of ten years reduces this yield to 300 or 400 pounds, the staple remaining about the same. Crab-grass is most troublesome.

Cotton comprises one-half the crops, and shipments are made by railroad to Augusta at 75 cents per bale, and to Atlanta at 50 cents.

CLAYTON.

Population: 8,027.—White, 4,938; colored, 3,089.
Area: 140 square miles.—Woodland, all; metamorphic, all.
Tilled lands: 39,995 acres.—Area planted in cotton, 17,422 acres; in corn, 11,458 acres; in wheat, 3,849 acres; in oats, 3,496 acres; in rye, 24 acres.
Cotton production: 6,606 bales; average cotton product per acre, 0.38 bale, 540 pounds seed-cotton, or 180 pounds cotton lint.

Clayton county is almost entirely included in the central granite area. The Atlantic and Gulf water-divide passes southward through it, the Central railroad marking its summit, which otherwise is not prominent.

The northern part of the county is undulating and hilly, the summits of the ridges being rounded or often flat, in many places furnishing areas of almost level lands, well suited for farms. The lower portion of the county is not so hilly. The streams have low banks and narrow, sandy bottom lands. The soils are mostly the usual gray sandy or gravelly, peculiar to the granites (see general part, page 35).

One per cent. of the area of the county is said to be too broken and the same proportion too swampy for tillage. The character of the soil and growth and methods of culture are similar to those of adjoining granitic counties.

A large proportion of the original timber growth has been removed. Lands under cultivation embrace 44.6 per cent. of the county area, cotton being the chief crop, its acreage averaging 124.4 acres per square mile, or 43.6 per cent. of the tilled lands. In the former regard it is surpassed only by the counties of Pike, Troup, and Houston. Cotton is shipped by railroad either to Atlanta, Macon, or Savannah.

The experiment with fertilizers, by J. M. Hull, of Jonesboro', on sandy lands that had been under cultivation for fifteen years and partially manured, gave the following results:

The yield without fresh application of fertilizers was about an average of 800 pounds per acre of seed-cotton. With fertilizers the yield varied from 950 to 1,120 pounds in twenty-five experiments with different fertilizers. The season was unfavorable for cotton. With corn, the application of fertilizers increased the yield from 13 to 18 bushels.

CAMPBELL.

Population: 9,970.—White, 6,085; colored, 3,885.
Area: 240 square miles.—Woodland, all; metamorphic, all.
Tilled lands: 61,411 acres.—Area planted in cotton, 21,448 acres; in corn, 14,056 acres; in wheat, 5,774 acres; in oats, 5,269 acres; in rye, 31 acres.
Cotton production: 8,986 bales; average cotton product per acre, 0.42 bale, 597 pounds seed-cotton, or 199 pounds cotton lint.

The surface of Campbell county is rolling, broken, and hilly, and is well timbered. The Chattahoochee river forms its northern boundary, receiving the drainage from a large portion of the county. On the southeast the streams are tributary to Flint river.

Granitic lands cover the largest part of the county in two separate areas, which, however, unite on the north. The largest of these covers that part of the county lying east of the Atlanta and West Point railroad, and forms a

portion of the large central granite region of the state. The country is high and rolling, with some broad and level tracts, the rock appearing both as outlying bowlders and as "flat rock". The latter is seen at Palmetto, where it forms for a short distance the bed of the railroad. Both the black and light varieties of mica enter into the rock composition, and red lands are found occasionally, though the soils are generally gray and sandy.

The other granite area forms a narrow belt near to and parallel with the Chattahoochee river, and on the southeast side of it is a strip of itacolumite sandstone with mica-schists, which form the ridge on which Campbellton is situated.

The granite appears in large bowlders, and these on the southwest are very numerous and "weather" slowly. Between the two granite outcrops or sections there is a region of country broken and hilly, with broad level areas, and having gray, mulatto, and red lands, the latter forming a belt which extends southwestward into Coweta county. Some trap-rocks are found a short distance west of Palmetto. This central portion is comparatively thinly settled. Within the bends of the Chattahoochee river there are large tracts of alluvial lands, level, highly productive, and nearly, if not quite, all in cultivation. Forty per cent. of the county area is under tillage, the chief crops being cotton, corn, oats, and some wheat. Cotton has the largest acreage, comprising 34.9 per cent. of the tilled lands, and averaging 89.4 acres per square mile. Its yield per acre is high, the county ranking as eleventh in the state.

Shipments are chiefly made to Atlanta.

DOUGLAS.

Population: 6,934.—White, 5,463; colored, 1,471.

Area: 190 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 29,330 acres.—Area planted in cotton, 9,520 acres; in corn, 10,586 acres; in wheat, 3,521 acres; in oats, 3,189 acres.

Cotton production: 4,099 bales; average cotton product per acre, 0.43 bale, 615 pounds seed-cotton, or 205 pounds cotton lint.

The surface of Douglas county is hilly and broken, and 10 per cent. is thought to be too much so for successful tillage. The drainage is all to the Chattahoochee river, which forms the southern boundary. There are two belts of granite extending across the county in an easterly course. One of these, in the northern part, forms a low ridge, on which Douglasville, the county-seat, is situated, and extends from Pine mountain, near Villa Rica on the west, to Salt Springs on the east, where it passes northward into Cobb county. The soil of this ridge is gray gravelly and sandy, and, owing to its narrow and rocky area, is not very much under cultivation. On the north of this belt the red clay lands predominate, derived from decomposed hornblendic material. Some of the lands have a thin sandy soil over the red clays.

The other narrow granitic belt lies in the middle of the county from Crawfish creek eastward, and is characterized by a level country and a growth of long-leaf pine. The soil is gray sandy and rocky. Between these granite belts the country is rolling and the lands are mostly red or mulatto-colored clays, with frequently a thin sandy soil.

South of the middle granite belt the country is at first but slightly hilly, but near the river it becomes very broken and rough, with high hills facing the river valley. The soil is very gravelly, from the innumerable small quartz veins that exist in the underlying and outcropping gneisses. Garnets enter largely into the composition of these rocks in localities. (See analysis, page 33.)

The river valleys are in this county wide and very fertile, and are largely devoted to cotton culture. But 24.1 per cent. of the county area is under cultivation, the acreage of corn being greater than that of any other crop. Cotton has an average of 50.1 acres per square mile, and embraces 32.5 per cent. of the tilled land. In its cotton product per acre the county ranks with Fulton and Gwinnett, or as seventh in the state.

ABSTRACTS FROM THE REPORTS OF J. E. HENLEY, M. D., OF CAMPBELLTON, AND F. M. DUNCAN, OF DOUGLASVILLE.

Cotton comprises nearly one-half the crops of the uplands. A cold and wet spring usually occurs, which is injurious to the cotton-plant, and, if followed by a dry summer and wet fall, results in a total failure of the crops.

The *gray lands* of the uplands cover three-fifths of the county, and have a growth of oak, hickory, chestnut, black-jack, and pine. They yield from 700 to 1,000 pounds of seed-cotton per acre when fresh, or 400 pounds after ten years' cultivation. The staple rates as low middling, but from old lands is shorter and finer than at first; 1,545 pounds make 475 pounds of lint. The height of the stalk is from 3 to 5 feet, running to weed in wet places. The liberal application of fertilizers prevents this tendency.

The *red and mulatto lands* differ from the gray in having sometimes walnut and but little pine. They are best adapted to wheat, though producing cotton as well as the gray lands. Hog- and rag-weeds and crab-grass are very troublesome on all the uplands. About 10 per cent. of lands once cleared now lie turned out.

The *river valleys* are in many places in this county quite wide and rich, and furnish the county with a large part of its cultivated lands. The growth is sweet gum, white and red oak, hickory, walnut, poplar, elm, maple, etc. The soil is a dark, fine sandy loam, 10 inches in depth, over a red clay. It is best adapted to cotton, which comprises one-half of the crops, grows to a height of from 3 to 5 feet, and yields 1,000 pounds of seed-cotton per acre when fresh and 800 after twenty years' cultivation, 1,720 pounds of seed-cotton making 475 pounds of lint. The crops are most troubled with rag-weeds, and especially crab-grass. To prevent these bottom crops from running to weed commercial fertilizers are used. One-tenth of the lands now lies turned out, being much benefited by rest.

Shipments are made about the 1st of December to Atlanta, by rail, at $1 per bale.

CARROLL.

Population: 16,901.—White, 14,591; colored, 2,310.

Area: 540 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 85,683 acres.—Area planted in cotton, 22,593 acres; in corn, 28,964 acres; in wheat, 10,414 acres; in oats, 7,729 acres; in rye, 134 acres.

Cotton production: 9,300 bales; average cotton product per acre, 0.41 bale, 588 pounds seed-cotton, or 190 pounds cotton lint.

Carroll county has a rolling surface, and is covered very generally with gray sandy and gravelly soils. Quartz fragments, some quite large, are found in various sections, and common garnets from the size of a pea to an inch or two in diameter are often associated with the gneisses.

Red lands from hornblende occur in small and large areas over the county, but the most prominent are on the Tallapoosa river, northwest of Carrollton, and along the county-line on the north. The county is well timbered throughout with oak, hickory, short-leaf pine, etc., and 24.8 per cent. of its area is under cultivation. The county properly belongs to the chief gold belt of the state, and several mines are worked. Copper ores also exist. Corn is the chief crop of the county, while cotton comprises 26.4 per cent. of the tilled area, and averages 41.8 acres per square mile. In average product per acre it ranks as seventeenth. The following experiment was reported to the state department of agriculture by G. A. McDaniel:

The yield of freshly-cleared *gray sandy land* without fertilizers is 300 pounds per acre; the same with 200 pounds of commercial fertilizers, 800 pounds of seed-cotton per acre. On land nine years in cultivation and previously fertilized the yield was 860 pounds per acre; the same with a fresh application of 200 pounds gave a yield of from 1,067 to 1,330 pounds of seed-cotton per acre. Red lands that had been twenty-five years in cultivation and partly manured gave a yield of 800 pounds. The application of 250 pounds fertilizers produced a yield of 1,200 pounds per acre.

ABSTRACT FROM THE REPORT OF R. H. SPRINGER, OF WHITESBURG.

The uplands vary greatly in character, from good to those worthless except for timber. They are preferred to the bottom lands, which are late in their crops. Three varieties or classes of soils are distinguished. The *light sandy uplands*, with pine, oak, and hickory growth, and a depth of 6 inches to a red or yellow or clay subsoil, is early, warm, well drained, easy to till, and is best adapted to cotton, which comprises about 50 per cent. of the crops. It yields when fresh about 600 pounds of seed-cotton per acre, or 200 pounds of lint, rating as first-class low middling. Ten years reduces this yield to 250 pounds of seed-cotton and the staple to "ordinary", 1,545 pounds being required to make 475 pounds of lint. The plant runs to weed with too much rain, heavy fertilizing being the remedy. Crab-grass and rag-weeds are most troublesome on this land. Horizontalizing is used, with only partial success, in preventing the clay washings from hillsides, which cover up and impoverish the valleys,

The *red lands*, with their heavy red-clay subsoils and growth similar to that of the gray lands, are early, warm, and easy to till. Cotton, which comprises one-third of the crops, grows to a height of 2 feet, and yields, when the land is fresh, 700 pounds of seed-cotton per acre, 1,485 pounds making 475 pounds of lint. The land rapidly deteriorates, and in ten years the product is only about 200 pounds of seed-cotton, 1,545 pounds being required for 475 pounds of lint.

The *bottom lands*, 6 inches deep, with red and yellow clay subsoils, are also devoted largely to cotton, which grows 4 feet high and yields 800 pounds of seed-cotton per acre on fresh land, the lint rating as first class. These lands also rapidly fail, and in ten years the yield is only 300 pounds, and its lint rates second class.

Shipments of cotton are made, by railroad, to Newnan, and thence to Atlanta and other points.

HEARD.

Population: 8,769.—White, 5,674; colored, 3,095.

Area: 290 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 47,761 acres.—Area planted in cotton, 17,348 acres; in corn, 17,209 acres; in wheat, 4,900 acres; in oats, 3,092 acres; in rye, 40 acres.

Cotton production: 5,900 bales; average cotton product per acre, 0.34 bale, 486 pounds seed-cotton, or 162 pounds cotton lint.

The Chattahoochee river divides Heard county into two sections. On the east side there is a granite belt or ridge from 150 to 200 feet above the river, which crosses it below Franklin and extends into Alabama. The rest of the county on the east and southeast is rolling and broken, the ridges being broad and flat, with granites and gray gneisses, which form gray sandy and gravelly soils, and have a growth of oaks, hickory, and chestnut on the uplands, and beech, maple, poplar, and sweet and black gums along the streams.

The country west of the river is rugged and mountainous, rising toward the northwest to an elevation of 600 feet above the river. This northwestern portion is extremely broken and hilly and rather thinly settled. Black Jack ridge crosses the corner of the county from Carroll county into Alabama.

The "Backbone" ridge lies to the west, having in its formation itacolumite sandstone and magnesian rocks; but to the northwest the formation is chiefly composed of mica-schists and gray gneisses full of small quartz veins, forming soils mostly gray, with the usual associated red clays and sands in patches and narrow belts. These lands extend southward over the rest of the county, which is much more level. The growth of this western section is tall long-leaf pine, scrub oak, and hickory, and on uplands some small areas have oak, hickory, and chestnut exclusively. On the banks of the streams are poplars, gum, ironwood, laurel, and wild cucumber trees.

About 2 per cent. of the county area is said to be too broken for tillage, and the same amount is of irreclaimable swamp. The lands under cultivation comprise 25.7 per cent. of the county area. Cotton and corn have nearly the same acreage, the former having an average of 59.8 acres per square mile, or 36.3 per cent. of the tilled lands.

The effect of judicious fertilization on both gray and red lands is shown in the following experiments by J. C. Brewer, of Antioch, on three plats of land:

1. Gray sandy soil, red-clay subsoil, cultivated six years; no manure previously used. Original growth, pine, hickory, post oak, and red oak. Yield without fertilizers, 630 pounds of seed-cotton per acre; yield with fertilizers, from 910 to 1,111 pounds of seed-cotton.

2. Soil and growth same as No. 1; has been but slightly manured previously, and has been in cultivation fifty years. Yield, about 600 pounds per acre; when freshly fertilized, from 910 to 1,137 pounds of seed-cotton per acre.

3. Stiff red clay soil; original growth, oak, hickory, poplar, and black gum. Cleared in 1874, and well fertilized each year. Yield, 1,500 pounds per acre; yield with fresh fertilizers, from 1,610 to 1,977 pounds of seed-cotton.

In this last plat the effect of yearly fertilization is shown by the large yield without fresh applications. These results were corroborated in the next year by a still greater yield.

ABSTRACT FROM THE REPORT OF R. H. JACKSON, OF FRANKLIN.

The *gray sandy lands* of the county are the ones chiefly devoted to cotton. The gray soils of the river bottoms are also very rich, have a depth of 36 inches, and produce cotton very well. The gray lands of the uplands have a depth of from 2 to 8 inches, with a red or yellow subsoil. The soil is easily tilled, and produces good crops of cotton, corn, wheat, and oats, but is best adapted to cotton. This grows to a height of 48 inches, producing from 800 to 1,000 pounds of seed-cotton per acre, the lint rating as good ordinary. After a few years' cultivation the yield is diminished from 300 to 600 pounds, or, if manured, from 500 to 1,000 pounds per acre, and 1,660 pounds are required to make 475 pounds of lint. Rag-weeds and crab-grass are most troublesome to these crops. One-twentieth of the land now lies out, due probably to the washing and gullying to which the soil is very subject. The valleys are not much injured. Hillside ditching, when well done, is successful in checking the damage.

Cotton, when baled, is hauled to La Grange in wagons, and there sold to merchants.

COWETA.

Population: 21,109.—White, 9,305; colored, 11,804.

Area: 440 square miles —Woodland, all; metamorphic, all.

Tilled lands: 116,956 acres.—Area planted in cotton, 48,494 acres; in corn, 28,980 acres; in wheat, 9,392 acres; in oats, 10,385 acres; in rye, 76 acres.

Cotton production: 16,282 bales; average cotton product per acre, 0.34 bale, 477 pounds seed-cotton, or 159 pounds cotton lint.

The general elevation of Coweta county is about 975 feet. Its surface is hilly and broken on the east and west, and higher, though quite level in the central portion—the water-divide. The lands embrace belts of gray and red soils underlaid by clay subsoils. The small streams are tributary in part to the Chattahoochee river on the west and in part to the Flint on the east.

On the west and northwest is a large area of feldspathic granites—a very broken and hilly country having a gray sandy and gritty soil with quartz gravel. On the east of this the country is more level, with a belt of gneisses 5 miles in width, also giving a gray sandy soil, intermixed with some red lands, from associated mica-schists and hornblendic rocks. Between this belt and Newnan on the east, a distance of 8 or 10 miles, are two belts of red hornblendic clay lands, extending a little east of north into Campbell county and southward into the northwestern corner of Meriwether county. But little quartz is found in these belts, and between the belts are found the gray feldspathic soils. East of Newnan to Sharpsburg are chiefly red soils, derived from hornblendic rocks and mica-schists, but east to the county-line the lands are chiefly gray, with outcrops of feldspathic gneisses and some granite. These latter soils are characteristic of the northeast, east, and southeast portions of the county. They contain much quartz gravel, and the country is very broken, with a prominent growth of long- and short-leaf pine, and oaks, chestnut, and hickory. The largest trap dike in the state has its upper limit in this county just north of Newnan, and passes east of White Oak creek, with an increasing width southward into Meriwether county. Its breadth is about 125 yards. The rocks are of all sizes, very hard and rounded, the weathered and decomposed surface forming deep yellow soils; its area is not tillable.

The lands under tillage embrace 41.5 per cent. of the county area. The crops are cotton, corn, small grain, sorghum-cane, and potatoes. The acreage of cotton is by far the largest, averaging 110.2 acres per square mile, or 41.5 per cent. of the tilled lands. In the former respect the county ranks as tenth in the state and as fourth in the total number of bales produced.

ABSTRACTS FROM THE REPORTS OF A. W. STOKES AND BENJAMIN LEIGH, OF NEWNAN.

The lands of the county may be classed as—

1. *Gray sandy or pine-woods lands*, covering the largest part of the county, and having gray sandy soils, 3 inches deep, sometimes black in the pine woods from decayed vegetation. The subsoil is a pale red clay, compact and stiff, changing sometimes to a pale yellow, and to white about the swamp, baking hard when exposed, but gradually becoming like the surface soil when properly cultivated. The soil is easy to till in dry seasons, is early when well drained, and is best for cotton, to which one-half of the cultivated soil is devoted. The plant usually grows 18 inches high, and is most productive at 24, yielding 600 pounds of seed-cotton per acre on fresh land, 1,545 pounds being required to make 475 pounds of lint. After five years' cultivation the yield is reduced to 300 pounds, and 1,660 pounds make 475 pounds of lint, which is harsh, short, and dry, and generally classed one grade lower than that from fresh land. The crops are troubled with rag-weed, crab-grass, and "May-pop" vines. In warm, rainy weather the plant is liable to run to weed; topping and manuring restrain it. One-half, and in some parts of the county three-fourths of the land lies out, but if vegetable matter be applied it yields nearly as well as at first. The soil washes and gullies badly, doing serious damage to the valleys below, almost destroying their fertility. Horizontalizing and hillside ditching are resorted to with success in checking the damage.

2. The *red stiff or mulatto lands* cover about one-fourth of the county, and have a growth of post and red oaks and hickory, with some chestnut, poplar, and pine. The soil is gravelly in places, has a depth of from 4 to 8 inches and a stiff, tough red-clay subsoil, that bakes very hard when worked wet. It is properly called hard-pan, is quite impervious, and is ruinous when mixed with the soil. The soil is early if well drained and not worked too wet. It is best adapted to wheat, corn, and oats, though cotton comprises about one-third of the crops. This latter grows to a height of 2 feet, producing, when fresh, 500 pounds of seed-cotton per acre with long and strong lint. Five years' cultivation reduces the yield to 300 pounds, and the lint is shorter, harsher, and rates about two grades lower; 1,660 or 1,720 pounds are required to make 475 pounds of lint. The "May-pop" and "saw briers" are most troublesome. Two-thirds of this land now lies turned out. The land washes badly, ruining the valleys below. Terracing the uplands and leveling the valleys are found to be beneficial.

3. The *bottom lands* along the streams are very narrow, and, while extremely rich, are not as much esteemed for cotton as even the indifferent uplands. The stalk runs too much to weed, and does not mature soon enough to produce a remunerative crop before frost. Heavy manuring and thick planting seem to obviate this difficulty, especially when planted with an early variety of seed.

Cotton is sold at Newnan, the county-seat.

FAYETTE.

Population: 8,605.—White, 5,742; colored, 2,863.
Area: 220 square miles.—Woodland, all; metamorphic, all.
Tilled lands: 59,278 acres.—Area planted in cotton, 21,787 acres; in corn, 14,195 acres; in wheat, 4,259 acres; in oats, 3,477 acres; in rye, 16 acres.
Cotton production: 7,131 bales; average cotton product per acre, 0.33 bale, 465 pounds seed-cotton, or 155 pounds cotton lint.

A prominent feature of Fayette county is the prevalence of gray granitic soils over the entire county, with here and there a spot of red land, from associated hornblendic rocks. The county lies in the fork of Flint river and Line creek, while Whitewater creek flows south through the middle portion. The granite outcrops are not as prominent as in counties north, and seem to have been disintegrated more fully.

The surface of the country is slightly hilly and undulating, but all of it is probably tillable. Two narrow belts of red lands occur at 2½ and 5 miles, respectively, south from Fayetteville, each with a width of from one-half to three-fourths of a mile. One-half of the county is said to have been cleared of its timber growth, which comprised oak, hickory, and pine; but near Brook's station long-leaf pine forms a prominent feature.

The tilled lands embrace 42.1 per cent. of the county area. Cotton is the chief crop, and has an average of 99 acres per square mile, or 36.8 per cent. of the lands under cultivation. The average product per acre is low, although fertilizers are used more or less in cotton culture.

ABSTRACT FROM THE REPORT OF ISAAC G. WOOLSEY, M. D., OF FAYETTEVILLE.

The lands of this county consist of creek and branch bottoms, and uplands, or a mixture of gray, red, or mulatto soils, with clay subsoils.

The *uplands* are devoted chiefly to cotton culture, the gray sandy lands being better than the red.

The *gray lands* cover 75 per cent. of the area of the county, and have a growth of oaks of several varieties, pine, chestnut, and hickory. The soil is from 3 to 6 inches deep, and has a clay subsoil. It is rather late, cold, and ill drained, is easy to cultivate, and is best adapted to cotton. The crops of the county are cotton, corn, wheat, oats, potatoes, etc. Cotton comprises 60 per cent. of these, grows to a height of from 2 to 4 feet, and yields 800 pounds of seed-cotton per acre when fresh. By a cultivation of six years the yield is reduced some 300 or 500 pounds, and the fiber becomes shorter; 1,545 pounds make 475 pounds of lint. Very little of the land lies out, and when it is again taken in it yields almost as much as when fresh. It is very much injured by washing, but this is readily prevented by hillside ditching and rock dams. The valleys are usually improved by the washings of the uplands. Crab-grass is the chief enemy to cotton crops. But little cotton is planted on the creek bottoms, as it is liable to rust.

Cotton is shipped by railroad either to Atlanta or to Savannah.

SPALDING.

Population: 12,585.—White, 5,439; colored, 7,146.
Area: 220 square miles.—Woodland, all; metamorphic, all.
Tilled lands: 53,335 acres.—Area planted in cotton, 22,935 acres; in corn, 15,560 acres; in wheat, 4,084 acres; in oats, 3,132 acres; in rye, 18 acres.
Cotton production: 7,418 bales; average cotton product per acre, 0.32 bale, 462 pounds seed-cotton, or 154 pounds cotton lint.

The surface of Spalding county is rolling and broken, well timbered, and is about equally divided between the gray granitic lands on the north and the red and gray sandy lands on the south. The Central railroad, in its southerly course through the county, has its road-bed along the top of the Atlantic and Gulf water-divide, a low ridge with gradual descents eastward, and to the Flint river on the west. Griffin, which is situated on this ridge, has an altitude of 975 feet above the sea. The granitic lands, with their gray sandy and gravelly soils, cover all the northern part of the county to within 3 miles north of Griffin, the region also extending southward through the county on the west. Black mica enters largely into the composition of the rock, producing in some localities a red soil.

A narrow belt of red land is found 3 miles north of Griffin, crossing the Newnan railroad 4 miles west of the town and covering a large area in the southern part of the county. On the southeast both gray and red lands are found intermixed, but the gray predominates. Three per cent. of the county area is said to be too swampy and 2½ per cent. too broken for cultivation. Lands under cultivation comprise 37.1 per cent. of the county area, and are chiefly planted in cotton, corn, and small grain. Cotton has the greatest acreage, and averages 104.3 acres per square mile, or 43 per cent. of tilled lands.

ABSTRACTS FROM THE REPORTS OF J. M. KELB, S. F. GRAY, AND H. T. PATTERSON, OF SUNNY SIDE.

The chief cotton lands are the uplands, with their variety of red, gray, and mulatto soils. The lowlands have but a small area devoted to cotton on account of early fall frosts, which cut off the crop.

The *gray lands*, with their sandy soils, from 3 to 12 inches deep, comprise 60 per cent. of the area of the county. The subsoil is a red and yellow clay, gradually mixing with the surface soil, and when plowed in wet weather is apt to bake. The growth is red, white, post, and Spanish oaks, chestnut, hickory, pine, poplar, gum, ash, birch, and elm. The soil is best adapted to cotton, though all crops do well, and the peach and grape are profitably cultivated. Cotton, comprising 50 per cent. of the crops, grows to an average height of 3 feet, and yields 1,000 pounds of seed-cotton per acre on fresh lands, with middling lint. After six years' cultivation the product is

600 pounds per acre, and 1,545 pounds are required for 475 pounds of lint. Rag-weeds and crab-grass are most troublesome. Ten per cent. of these lands now lie out, and, as they usually grow up in sedge-grass, they soon are as good as when fresh. No damage is done by the washing or gullying of the uplands.

The *red lands*, which are interspersed with the gray and have the same growth, have a red-clay loam soil, from 3 to 10 inches in depth, over a red and stiff clay subsoil. Cotton is planted to the extent of 50 per cent., grows to 3 feet in height, and yields 800 pounds of seed-cotton per acre on fresh land and 500 pounds after six years' cultivation. Rag-weed, crab-grass, and May-pop vines are most troublesome. Ten per cent. of these lands also lie out, but produce finely after a rest. These red uplands do not wash much.

The *mulatto lands*, or a mixture of the red and gray, have the same growth as above. Cotton grows to a height of from 3 to 5 feet, but is most productive at 4 feet, and yields 1,200 pounds of seed-cotton per acre on fresh land and 1,000 pounds after six years' cultivation. Five per cent. of these lands now lies out. Cotton is sold, as soon as ginned, at Griffin or other stations.

HENRY.

Population: 14,193.—White, 7,961; colored, 6,232.

Area: 400 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 73,583 acres.—Area planted in cotton, 35,730 acres; in corn, 21,903 acres; in wheat, 7,406 acres; in oats, 5,321 acres; in rye, 44 acres.

Cotton production: 10,930 bales; average cotton product per acre, 0.31 bale, 435 pounds seed-cotton, or 145 pounds cotton lint.

Henry county is rolling and hilly, the streams all flowing eastward from the Atlantic and Gulf water-divide, which crosses the southwestern corner of the county. The lands are almost entirely granitic, with gray sandy and gravelly soils, associated with patches, and a few narrow belts of red sandy clays or mulatto lands. At Locust Grove, McDonough, and northward are found areas of red lands, derived largely from the biotite mica of the rocks, while over the rest of the county these spots are abundant.

Of the lands of the county 1⅔ per cent. is said to be too broken and 3 per cent. too swampy for tillage. It is thought that 68 per cent. of the original timber growth has been removed. The lands under cultivation embrace 28.7 per cent. of the county area, and of this 48.6 per cent. is in cotton, the chief crop, its average being 89.3 acres per square mile.

ABSTRACT FROM THE REPORT OF J. A. C. WYNN, OF WYNN'S MILL.

The lands of the county may be classed as follows: Gray sandy and red uplands, with a small area of sandy bottoms. The *sandy and gray uplands*, comprising one-half of the county area, with a stiff clay subsoil and a growth of red and post oaks and hickory, are best adapted to cotton and corn, one-half of the cultivated lands being devoted to the former. The uplands wash readily, injuring the valleys slightly. Very little of the land now lies idle, as the old lands are found to produce very well by the application of 100 pounds of guano per acre. Fresh lands yield 800 pounds of seed-cotton per acre. The lint rates as good middling. After ten years' cultivation the yield is 500 pounds, with low middling staple; 1,545 pounds are then required to make 475 pounds of lint. Rag-weeds are most troublesome.

The *bottom lands* have a growth of poplar, sweet gum, white oak, and beech, and are best adapted to corn, but little cotton being planted on them.

Cotton is sold to local buyers.

NEWTON.

Population: 13,623.—White, 6,740; colored, 6,883.

Area: 260 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 65,039 acres; area planted in cotton, 27,801 acres; in corn, 17,112 acres; in wheat, 4,892 acres; in oats, 4,999 acres; in rye, 36 acres.

Cotton production: 7,796 bales; average cotton product per acre, 0.28 bale, 399 pounds seed-cotton, or 133 pounds cotton lint.

Newton county, through the center of which flows the Yellow river and other parallel streams, all flowing southward into the South river, has a slightly rolling surface.

That portion of the county east of Covington to within 4 miles of Rutledge has chiefly sandy red clay lands, produced from the decomposition of biotite gneisses, which are the prevailing rocks. From Covington westward to Rocky Plains a gray sandy soil predominates, with yellow or red subsoils; while still farther westward are gray granitic lands, with flat outcrops of the rock. The granite is fine grained, and is much used for building purposes. These various belts extend north and south through the county parallel with the streams.

There are in the county cotton and woolen mills, and flour, corn, and lumber mills are abundant. Sixty-three per cent. of the tillable land is said to have been cleared. Of the total area 39 per cent. is under tillage. Cotton is the chief crop, with an average of 106.9 acres per square mile, or 42.8 per cent. of the tilled lands. Its average product per acre is very low.

ABSTRACTS FROM THE REPORT OF L. F. LIVINGSTON, OF COVINGTON, AND JESSE W. WALKER, OF SOCIAL CIRCLE.

Cotton is not grown on the lowlands, as it will not mature and is killed by frost. The soil of the bottoms is a black loam, underlaid by whitish clay.

The cotton lands of the county may be classed as (1) a stiff red clay soil and subsoil, filled with gravel; (2) a light sandy soil, with clay subsoil, free from gravel; (3) a mulatto clay soil, free from gravel. Of these the *red clay uplands* are chiefly devoted to cotton, which comprises half of the crops. They have a coarse gravelly clay soil, 3 inches deep, a red-clay subsoil, gravelly and very productive when turned up a few months before cultivation; the growth is post, red, and black oaks, hickory, and pine. These lands extend from Covington 60 miles south, 70 miles east, and 40 miles north. They are early, warm, and well drained, easy to cultivate in dry but difficult in wet weather, and are best adapted to cotton. The cotton-plant grows to a height of from 15 to 24 inches, but runs to weed with

excessive rains, which is prevented by very shallow plowing and fertilizing with ammoniated fertilizers. Fresh lands yield 800 pounds of seed-cotton per acre. Its lint rates as middling. Ten years' cultivation without rotation or care of the soil reduces the yield to 400 pounds, but with a better staple. The older the land the better the staple, a good staple requiring a slow growth. "Crop" grass, a variety peculiar to this soil, is most troublesome to the crops. Hog-weeds appear after crops of wheat and oats. "Poor Peter" is also a troublesome weed. But very little red land now lies out; all is reclaimed and in cultivation. The uplands, and sometimes the valleys, are seriously injured by the washing and gullying of the soils, but some valleys are improved 50 per cent. Hillside ditching and horizontalizing are practiced to prevent injury, and with good success when properly done.

The *sandy gray soils*, extending west from Covington, have a growth of oak, chestnut, and pine, a depth of 5 inches, and an orange-red clay subsoil, not productive when turned up with the soil. The soil is early, warm, and well drained, easy to cultivate in dry and wet seasons, and is best adapted to cotton and potatoes. About one-half the cultivated lands is devoted to cotton, which grows to a height of from 10 to 18 inches and yields 600 pounds of seed-cotton per acre on fresh land. Ten years' cultivation reduces this to 300 pounds. The land is injured by washings, but the valleys are not much damaged.

The *mulatto lands* cover a very small portion of the county in a narrow belt reaching south, with a growth of hickory and oak. The brown or mulatto clay soil has a depth of from 4 to 6 feet, and is best adapted to cotton, which comprises two-thirds of the crops and grows to a height of from 2 to 4 feet, yielding 1,200 pounds of seed-cotton per acre on fresh land and 800 pounds after ten years' cultivation. Rag-weeds are most troublesome. One-eighth of these lands now lies turned out, but will produce well when again taken in. They do not wash or gully as readily as the gravelly clay lands.

The cultivation of cotton in this county has increased rapidly in the past ten years, owing to the use of fertilizers and to improved preparation and cultivation.

Shipments of cotton are made from Covington to Atlanta and to Augusta.

MORGAN.

Population: 14,032.—White, 4,249; colored, 9,783.

Area: 400 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 82,315 acres.—Area planted in cotton, 35,243 acres; in corn, 22,510 acres; in wheat, 4,980 acres; in oats, 4,017 acres; in rye, 111 acres.

Cotton production: 7,358 bales; average cotton product per acre, 0.21 bale, 297 pounds seed-cotton, or 99 pounds cotton lint.

Morgan county is hilly, and has a gradual fall from the west to the Oconee river on the southeast, all the streams flowing in that direction. The Georgia railroad passes through the center of the county almost east and west.

A broad belt, in which red lands predominate, passes north and south, extending in width from 4 miles east of Rutledge eastward to 1½ miles east of Madison, where gray sandy lands appear. Other narrow belts are found beyond this, and over the southern part of the county the red lands are very prevalent. These lands are formed from granites in which biotite gneiss is a large constituent, and which gives to the former their red character.

The gray lands of the northeast part of the county, and also on the east of Sugar creek, are very gravelly, and abound in quartz fragments, differing in that respect from the gray sandy lands on the west and south.

It is estimated that 5 per cent. of the county area is too hilly for successful cultivation, and that 2 per cent. consists of irreclaimable swamp lands. Some of the uplands between the streams present broad level areas, which are choice lands for cultivation; 62½ per cent. of the original forest has been cleared. The crops of the county are cotton, oats, corn, potatoes, and wheat.

There are in the county a cotton factory, carriage and wagon factories, and flour, corn, and lumber mills.

Lands under tillage embrace 32.2 per cent. of the county area. Cotton has an average of 88.1 acres per square mile, or 42.8 per cent. of tilled lands. The average product per acre of cotton is very small.

ABSTRACT FROM THE REPORT OF GRANT D. PERRY, OF MADISON.

The lands vary greatly from one stream to another, but may be generally classed as follows: Dark red loam, 4 inches deep, with red subsoils, and covering half of the county; gray sandy lands, 3 inches deep, with red subsoils, comprising 40 per cent. of the area; alluvial river lands or bottoms, comprising 10 per cent. of the area.

The *red lands* have a growth of oak, hickory, chestnut, poplar, gum, ash, and persimmon. Cotton comprises 60 per cent. of the crops on this soil, grows from 3 to 6 feet high, runs to weed in wet weather unless prevented by plowing close to the stalk, and yields from 800 to 1,000 pounds of seed-cotton per acre. The lint rates as good middling. After twenty years' cultivation the yield is diminished to 450 pounds. Crab-grass is most troublesome. Forty per cent. of these lands now lie turned out and are much injured by washing, which also damages some of the valleys.

The *gray lands*, having a growth of oak, hickory, chestnut, persimmon, and pine, are best adapted to cotton and oats, and are late and easy to cultivate. Seventy per cent. of cotton is planted on them. It grows to a height of from 2 to 4 feet, yielding 1,000 pounds of seed-cotton per acre on fresh land and 450 pounds after twenty years' cultivation.

The *bottom alluvial lands* along the creeks and large streams have a width of from 100 to 600 yards and a growth of gum, willow, alder, poplar, and oak. They have a clay loam soil from 10 inches to 10 feet in depth and a blue clay subsoil. The soil is late and somewhat difficult to till in wet seasons, and is best adapted to corn and oats. Cotton on these bottom lands is liable to be too late for full maturity. It grows to a height of from 4 to 7 feet, is most productive at 4 feet, and runs to weed in wet weather, which is prevented by plowing near the stalk and breaking the roots. Its yield on fresh land is 1,200 pounds of seed-cotton per acre, and after twenty years' cultivation the yield is 600 pounds, provided the uplands have not washed down and covered up the good soil with sand. Crab-grass gives most trouble on these bottoms. About 30 per cent. of the land lies out, but it produces well when again taken in.

Dry weather is a great drawback to the growth of upland cotton. The land is so poor that it must be stimulated with commercial fertilizers, which add so much to the cost that without good seasons there is no profit. Shipments are made by railroad to Augusta.

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GREENE.

Population: 17,547.—White, 5,573; colored, 11,974.
Area: 340 square miles.—Woodland, all; metamorphic, all.
Tilled lands: 91,224 acres.—Area planted in cotton, 40,037 acres; in corn, 25,827 acres; in wheat, 6,473 acres; in oats, 6,674 acres; in rye, 92 acres.
Cotton production: 12,448 bales; average cotton product per acre, 0.31 bale, 444 pounds seed-cotton, or 148 pounds cotton lint.

The surface of Greene county along the Oconee river is very hilly, with steep ascents from the river, but eastward the slopes are more gentle.

In the southeastern part of the county there is a large granitic area, in which the rocks appear in immense bowlders, having coarse feldspar crystals and forming gray gravelly soils. The granitic section extends westward to Richland creek, northwest to within one mile of Greensboro', and thence eastward.

A wide belt of red clay lands from hornblendic gneiss borders the granitic region, passing through Union Point, Greensboro', and thence southward. Westward from this to the river on the west, and northward for several miles, are gray sandy lands, with a few granite outcrops, interspersed with small areas of red lands. In the northern part of the county the red lands again predominate. (See analyses of soils, pages 33 and 35.)

It is thought that 58 per cent. of the county (originally timbered with oak, hickory, and pine) has been cleared. At present, however, but 41.9 per cent. of the total area is under tillage. Cotton is the chief crop, and averages 117.8 acres per square mile, or 44.9 per cent. of the tilled land. In the former regard the county ranks as seventh in the state, but in product per acre it is very low.

ABSTRACT FROM THE REPORT OF J. B. Y. WARNER, OF GREENSBORO'.

The *gray sandy uplands*, covering two-thirds of the county, are the chief cotton lands. They have sometimes a whitish, but usually red clay subsoil. The cotton stalk grows to a height varying from 6 inches to 6 feet, and is most productive at 2 or 3 feet. It runs to weed on red and rich lands during wet weather. Crab-grass, rag-weed, etc., give the crops much trouble. The lands produce from 1,000 to 1,500 pounds of seed-cotton when fresh. In some cases the yield in ten years is not more than half of this. About one-half of the lands originally under cultivation now lies out, and, if not washed much before turning out, yields a fair crop when again taken in. Some of the valleys and uplands are ruined by the washing of the latter; deep plowing is in rare instances practiced to prevent it, and with good success. The growth of the uplands is oak, hickory, chestnut, poplar, pine, dogwood, and black and sweet gums.

Shipments are made, via Augusta, to Charleston and to Savannah by rail.

TALIAFERRO.

Population: 7,034.—White, 2,312; colored, 4,722.
Area: 180 square miles.—Woodland, all; metamorphic, all.
Tilled lands: 46,616 acres.—Area planted in cotton, 14,058 acres; in corn, 9,901 acres; in wheat, 3,086 acres; in oats, 4,305 acres; in rye, 34 acres.
Cotton production: 4,758 bales; average cotton product per acre, 0.34 bale, 483 pounds seed-cotton, or 161 pounds cotton lint.

Through Taliaferro county there passes a ridge in an easterly course, dividing the tributaries of the Little river and of the Ogeechee, and marked by the Georgia railroad. Crawfordville, situated on this ridge, has an elevation of 618 feet above the sea.

The general surface of the county is rolling, with granites on the southwest, center, and northeast, clay-slates on the east of Crawfordville toward Raytown, and hornblendic rocks on the north, each with their characteristic gray gravelly, gray clayey, and red clay or mulatto lands.

The crops of the county are corn, cotton, wheat, oats, and sorghum. The entire county is tillable, and 50 per cent. of the original timber growth is thought to have been removed. The tilled lands comprise 40.5 per cent. of the total area, cotton being the chief crop, with an average of 78.1 acres per square mile.

ABSTRACT FROM THE REPORT OF LIONEL L. VEAZEY, OF CRAWFORDSVILLE.

The cotton lands of the county are classed as red, mulatto, and gray, and are all adapted to corn and cotton. Cotton comprises half the crops, grows to a height of from 3 to 5 feet, and yields 800 pounds of seed-cotton per acre (sometimes more) on fresh land. After three years' cultivation the yield is only 600 or 800 pounds per acre, 1,545 pounds of seed-cotton making 475 pounds of lint, which rates as first-class from new lands and a little lower from old. Carrot- and hog-weeds are most troublesome. One-fourth of the lands now lies out; after fifteen or twenty years' rest they produce almost as well as fresh lands. The uplands wash readily and are seriously damaged, but the valley lands are rather improved.

Shipments of cotton are made to Augusta.

LINCOLN.

Population: 6,412.—White, 2,254; colored, 4,158.
Area: 280 square miles.—Woodland, all; metamorphic, all.
Tilled lands: 37,813 acres.—Area planted in cotton, 12,798 acres; in corn, 11,029 acres; in wheat, 2,125 acres; in oats, 7,035 acres; in rye, 13 acres.
Cotton production: 3,861 bales; average cotton product per acre, 0.30 bale, 429 pounds seed-cotton, or 143 pounds cotton lint.

The surface of Lincoln county is rolling and hilly, the most prominent point being Graves' mountain, on the west. A belt of granite extends through Lincolnton to the mountain, and another outcrop is found in the southwestern corner of the county, both forming gray sandy and gravelly soils. Over the rest of the county the red clayey and gray sandy lands are found in alternating belts. About 2½ per cent. of the area is too hilly or broken for cultivation. (See analysis of soil, page 37.)

Gold is being mined extensively. Graves' mountain is composed of a soft, friable sandstone, containing crystals of rutile; etc.

The drainage of the county is to the Savannah river. It is estimated that 37 per cent. of the original timber growth has been cleared; 21.1 per cent. of the total county area is under cultivation in corn, wheat, cotton, oats, and potatoes. Cotton is the chief crop, with an average of 45.7 acres per square mile, or 33.9 per cent. of the tilled lands.

The following experiment was reported by J. M. Dill, of Clay Hill, to the Georgia department of agriculture:

The land was a sandy loam, with clay subsoil, and had been in cultivation sixty years. The original growth was white and red oaks, hickory, etc.; had been lightly manured previous to 1879. Without fertilizers the yield was 665 pounds per acre; with fertilizers and compost, from 935 to 1,470 pounds of seed-cotton.

Another plat in the same field the following year gave, without additional fertilizers, 665 pounds average per acre; with fertilizers and composts, from 1,085 to 1,295 pounds of seed-cotton.

ABSTRACTS FROM THE REPORTS OF C. R. STROTHER AND N. A. CRAWFORD, OF LINCOLNTON.

Cotton is planted here on the uplands and bottoms. The upland is the surest for a crop, is planted earlier and matures faster, and is not so liable to rust as the sandy bottoms. The loamy bottoms with favorable seasons sometimes yield 1,500 pounds of seed-cotton per acre, but because of the better yield of corn on these lowlands they are but little devoted to cotton. From one-third to one-half of the uplands under cultivation is devoted to cotton.

Of the uplands the *gray sandy lands* having red-clay subsoils are best for cotton, and those are selected which are on southern slopes of hills, being more exposed to the rays of the sun in the spring and better protected from frosts and cold winds. The growth of these lands is post oak, black-jack, and hickory. The soil has a depth of about 6 inches to a stiff red-clay subsoil. The rocks are decomposed or disintegrated to a depth of 20 or 30 feet. The soil is early, warm, well drained, and easy to till, and is best adapted to cotton and oats. The former grows to a height of 3 feet, and runs to weed on fresh lands in wet weather, unless prevented by using stable manure, either in drill or broadcast. On fresh lands the yield is from 600 to 1,000 pounds of seed-cotton per acre, which is reduced to 500 pounds in five years' cultivation if not alternated with wheat or oats, 1,425 pounds from fresh and 1,545 from old lands making 475 pounds of lint, the staple in the former sometimes rating higher and bringing in market 1 cent more per pound. Crab-grass is the most troublesome on these gray lands. Seven-tenths of these lands originally in cultivation now lie out, and have a growth of old-field pine. They do not produce well when taken in again without the use of fertilizers. The valleys would be injured 50 per cent. by the washing and gullying of the gray uplands if a system of ditching or draining were not kept up by the best class of farmers.

The *red clay lands* also have a growth of oak and hickory and a subsoil of tough red clay, mixed with yellow streaks, yielding readily to a good two-horse subsoil plow. The soil is early when well drained, and is not difficult to work either in wet or in dry seasons, and all the crops succeed well if they receive proper attention. Cotton grows to a height of 30 inches, yielding 1,000 pounds per acre in dry seasons. In these clay lands, when the plant is inclined to run too much to weed, the use of superphosphates seems to check it and favor bolling. After five years' cultivation the yield is 400 or 600 pounds, the lint becoming lighter and the staple not so long. Rag- and hog-weeds are most troublesome on these clay soils; other varieties are easily subdued. About one-third of these lands now lies out, producing better cotton crops than when fresh when again taken in.

Gray gravelly soils.—Interspersed with the red and gray varieties are gray sandy soils having a yellow or black gravel, with much quartz. The depth is 3 or 4 inches, with a yellowish-white sand, very porous and miry in wet weather. This is underlaid by sand and gravel. This soil is adapted to corn and oats; cotton grows to a height of 3 feet, and yields 700 pounds of seed-cotton per acre when fresh and 300 or less after five years' cultivation.

Shipments of cotton are made, by wagon and by boat, to Augusta at $2 per bale.

WILKES.

Population: 15,985.—White, 5,173; colored, 10,812.

Area: 460 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 88,776 acres.—Area planted in cotton, 30,891 acres; in corn, 21,493 acres; in wheat, 4,287 acres; in oats, 11,855 acres; in rye, 463 acres.

Cotton production: 11,109 bales; average cotton product per acre, 0.36 bale, 513 pounds seed-cotton, or 171 pounds cotton lint.

The surface of Wilkes county is undulating and broken, the dividing granite ridge extending east and west through the middle of the county. The soil of this ridge is gray and sandy, and reaches southward over most of the county. To the northward there is a belt of alternating red clays and sands, the former apparently predominating. This belt has a southward course from Elbert county, and a width of but a few miles. Good clay subsoils underlie all of the county lands. A small part of a flatwoods belt lies still northward, on the county-line, and is a continuation of the flatwoods of South Carolina. The prominent growth of this belt is black-jack; the growth elsewhere is oak, pine, and hickory.

The bottom lands are narrow and sandy, and where above overflow are devoted chiefly to the culture of corn, owing to the liability of injury to cotton crops by rot and frosts. About one-third (30.2 per cent.) of the county area is now under cultivation, and 20 per cent. is said to consist of worn-out lands now lying out and covered with a growth of old-field pine. A small percentage also consists of irreclaimable swamp and of lands too broken for tillage.

Cotton is the chief crop, comprising 34.8 per cent. of the tilled lands, and averaging 67.2 acres per square mile. Its product per acre is greater than that of either the region or state at large.

The upper or northern part of this county is rolling, with outcropping metamorphic rocks, which are filled with gold-bearing quartz veins along the Little river. The gray sandy lands predominate, the red, forming large areas, being intermixed with them. The entire county was once thickly timbered, but now about half is said to have been cleared. The metamorphic section has the usual oak and hickory growth, while the pine hills are covered with their characteristic long-leaf pine, black-jack, and sweet-gum growth.

The crops of the county are cotton, corn, wheat, oats, potatoes, and sugar-cane.

Lands under tillage comprise 25.7 per cent. of the county area, and of these 45.6 per cent. are in cotton, its average being 75.2 acres per square mile. The product per acre of the county is below that of the region.

In comparing the enumeration reports of production of cotton in this county it is found that the largest yield per acre is in the militia district occupying the central part. The results are as follows: The northern part of the county averages 420 pounds of seed-cotton; the central part, 510 pounds; the southwestern part, 405 pounds; the southeastern part, 495 pounds per acre. The greater productiveness of the southeastern pine hills over the gray sandy lands of the north is due, apparently, to the liberal use of fertilizers.

ABSTRACT FROM THE REPORT OF A. E. STURGIS, OF THOMSON.

The lands of the county may be classed as dark-gray sandy, with clay subsoil, which are preferable for cotton; mulatto or red lands, also well adapted to cotton; sandy or pine lands, inferior to either of the others. Crops on the bottom lands are liable to be caught by frosts, and are also more subject to the boll-worm, to rust, and to rot than on the uplands; hence these lands are but little under cotton cultivation. These lowlands comprise the marshy, sweet-gum, and gallberry flats of the pine-hills region.

The *dark-gray soils*, comprising three-eighths of the lands of McDuffie, are from 4 to 12 inches deep, with a tough, yellow clay subsoil and a growth of post oak, big-bud hickory, and dogwood, with some red oak. One-third is planted in cotton. The plant grows to a height of from 1 foot to 4 feet, but is most productive at 3 feet, yielding from 800 to 1,200 pounds of seed-cotton per acre on fresh land. After ten years' cultivation the yield is from 400 to 600 pounds. From fresh lands 1,425 pounds make 475 pounds of lint, which rates as middling to good middling; from old lands 1,485 pounds are required for a bale, the lint rating as low middling to middling. The crops are troubled most with crab-grass. But little land lies out, and when taken in again it produces as well as at first. The gray uplands wash readily, and in some localities serious damage is done to them. The valleys, too, become filled up with sand, which injures their productiveness. Ditching is practiced with success in preventing this washing.

The *red lands*, covering one-third of the county, have clay loam soils 1 foot or 2 feet deep, a red clay, putty-like subsoil, a growth of oak, hickory, dogwood, poplar, and walnut, and are best adapted to wheat, oats, rye, and barley, though one-third is planted in cotton. The stalk of the latter runs to weed in wet weather and from deep plowing, unless restrained by topping and plowing shallow with a sweep. It yields on fresh land from 1,000 to 1,500 pounds of seed-cotton per acre, and from 600 to 800 after ten years' cultivation unmanured. Hog-weeds are most troublesome. Though washing readily, but little serious damage is done to the uplands, and none to the valleys.

The *pine lands* of the southern part of the county have a coarse sandy and gravelly soil from 1 foot to 2 feet deep, a yellow subsoil, underlaid with "chalk" (white pipe-clay) 10 feet below, and a growth of long-leaf pine, black-jack, and sweet gum, with black gum and poplar on the swamps. On the hills are red ferruginous pebbles. The lands are best adapted to pease, potatoes, and melons, though one-eighth is planted in cotton. Cotton grows to a height of 2 feet, and yields from 600 to 800 pounds of seed-cotton on fresh lands. Ten years' cultivation reduces this to 200 pounds. Crab-grass is most troublesome. A small proportion of these lands now lies out. They wash readily, suffering serious damage in some localities, and frequently render the valleys unfit for cultivation. Hillside ditching is practiced on every farm, and is very successful in preventing damage.

Shipments of cotton are made to Augusta at 1.5 cents per pound or 75 cents per bale.

WARREN.

Population: 10,885.—White, 4,039; colored, 6,846.

Area: 290 square miles.—Woodland, all; sand hills, 98 square miles; metamorphic, 192 square miles.

Tilled lands: 53,966 acres.—Area planted in cotton, 24,991 acres; in corn, 16,450 acres; in wheat, 3,649 acres; in oats, 4,885 acres.

Cotton production: 7,885 bales; average cotton product per acre, 0.32 bale, 447 pounds seed-cotton, or 149 pounds cotton lint.

Warren county lies partly in the metamorphic and partly in the pine- and sand-hills region, the two divisions differing greatly in surface features. The water-divide between the Savannah and Ogeechee river systems passes slightly northwestward through the county.

The metamorphic region extends southward to 6 miles beyond Warrenton, and on the creeks its rocks are exposed much farther south. The red and gray sandy lands occur in the north and northwest, granitic (pink feldspar) lands at Warrenton and southward, and gray clay lands at Camak.

The southern part of the county is covered with white sands and clays of the pine hills, and has a growth of long-leaf pine and black-jack.

The surface of the entire county is well timbered, rolling, and broken, but all considered tillable, and 29.1 per cent. is under cultivation in cotton, corn, wheat, oats, potatoes, etc.

There is but little bottom land on the creeks of the northern portion of the county. Cotton is the chief crop, and has an average of 86.2 acres per square mile, or 46.3 per cent. of the tilled lands.

ABSTRACTS FROM THE REPORTS OF JAMES A. SHIVERS AND JOHN S. JOHNSON, OF WARRENTON.

The soils of Warren county may be classed as red clay lands, rocky and rolling; light gray lands, rolling, and with a clay subsoil; and fine sandy table-lands of the pine hills.

The *red clay lands* are considered the best land of the county for crops in general. They comprise about one-third of its area; have a depth of from 4 to 6 inches, a red and yellow clay subsoil, very tough, but when properly worked in season are easy to manage. The growth is oak and hickory. The soil is difficult to till in wet but easy in dry seasons. One-third of the soil under cultivation is devoted to cotton.

The plant grows to a height of from 12 to 36 inches, and runs to weed with too much rain in June and July. It yields on fresh land from 800 to 1,000 pounds of seed-cotton per acre. After two years the yield is 1,200 pounds; four years, from 700 to 1,000; six years, from 600 to 900; and after ten years, from 500 to 800 pounds. Hog-weeds and crab-grass are most troublesome. From one-third to one-half of the land lies out. When again taken in these lands make better cotton for a few years, and are preferred, as they are easier cultivated. The uplands are seriously damaged by washing, but the valleys are improved from 10 to 20 per cent. Horizontalizing is practiced with success in checking the damage and in reclaiming old hillsides.

The *gray lands*, with red subsoils at a depth of from 4 to 18 inches, lie away from the water-courses, and have a growth of oak, hickory, ash, gum, maple, and pine. The lands are best adapted to cotton, and comprise one-third of the area of the county. The average height of cotton is 24 inches, and it yields from 1,000 to 1,200 pounds of seed-cotton per acre on fresh land. Cultivation of cotton for four years reduces this yield to 1,000 pounds, and for six years from 600 to 800 pounds.

The *sandy piny woods* of the southern part of the county cover one-third of its area, and have, besides the pine, a growth of black-jack. The soil is from 1 foot to 10 feet deep to a white clay. It is easy to till, early, warm, and well drained, and is best adapted to corn, wheat, and oats. On this land cotton grows to a height of 4 feet, and yields from 400 to 600 pounds of seed-cotton per acre. Cultivation of two years reduces this to 300 or 400; six years, to 200 or 300 pounds. One-third of this land now lies turned out, and is greatly improved by rest. These light and sandy uplands wash readily and do serious damage, but the valleys seem to be improved by the deposit of sand.

Fourteen hundred and twenty-five pounds of seed-cotton on all the lands of the county make 475 pounds of lint, except on the old lands of the pine hills, where 1,545 pounds of seed-cotton are required.

Shipments are made to Augusta by railroad at $1 20 per bale.

HANCOCK.

Population: 16,989.—White, 5,044; colored, 11,945.

Area: 520 square miles.—Woodland, all; sand hills, 132 square miles; metamorphic, 388 square miles.

Tilled lands: 99,397 acres.—Area planted in cotton, 42,773 acres; in corn, 33,328 acres; in wheat, 5,913 acres; in oats, 6,503 acres; in rye, 120 acres.

Cotton production: 15,010 bales; average cotton product per acre, 0.35 bale, 501 pounds seed-cotton, or 167 pounds cotton lint.

Hancock county is one of the border counties whose area embraces partly metamorphic and partly pine and sand-hills regions, with soils of greatly different character. The surface is mostly rolling, especially in the metamorphic portion of the county, which embraces the greater area, and which extends in width from the northern county-line to several miles south of Sparta. On the south the lands are more level, and embrace the sandy pine uplands. The Ogeechee and Oconee water-divide passes northward through the county, these two streams forming, respectively, the eastern and western boundaries.

In the metamorphic or northern section of the county there are two granitic regions: one a narrow strip on the north, next to Greene county; the other, of the pink feldspathic variety, in the region of Sparta, extending in a belt northeast and southwest. Long-leaf pine is a prominent growth on its gray sandy lands. Between these two granitic regions the lands are gray and more or less rocky, a red-clay subsoil usually underlying the surface at 6 to 12 inches. (See analysis of soil, page 37.)

The red lands pass across the county in a rather narrow northeasterly belt 4 miles north of Sparta and just south of the northern granite area. Its growth is chiefly oak and hickory.

The sand and pine hills of the southern part of the county embrace sandy ridges and level uplands, with often deep sand beds covering plastic and variegated clays. Long-leaf pine is a prominent growth of this region. The entire surface of the county is considered tillable, and it is thought that 56 per cent. of the original growth has been removed. The tilled lands embrace 29.9 per cent. of the total area, and are chiefly (43 per cent.) devoted to cotton, its average being 82.3 acres per square mile. The county ranks as eleventh in the state in its total acreage of cotton. The following experiment with fertilizers was made by John Turner, of Culverton, on gray sandy land:

The land has been in cultivation about sixty years and has been manured. The original growth was oak and hickory. The yield without fertilizers was 595 pounds of seed-cotton per acre. With commercial fertilizers and composts it ranged from 1,015 to 1,260 pounds of seed-cotton.

ABSTRACT FROM THE REPORT OF W. J. NORTHEN, OF SPARTA.

The culture of cotton in this county is confined almost exclusively to the uplands. Cotton fails to open on bottoms, and but few persons attempt to raise it on such land.

The uplands may be classed as darkish gray, mulatto, and red lands. The *gray land* is the chief cotton land, and covers one-third of the area of the county; has a depth of 4 or 5 inches, a mulatto or red subsoil, and a growth of oak and hickory. The crops of the county are cotton, corn, oats, wheat, potatoes, etc. The gray land is chiefly devoted to cotton, the red to small grain. Three-fourths of the land now lies out, and if allowed to grow up in pines the yield for a few years is equal to three-fourths of that of fresh land. The sandy nature of the land is favorable to the rapid washing away of the soil on hillsides, by which serious damage is done, though the valleys are usually improved. Owing to carelessness in opening the hillside ditches very little success attends the attempts to check the damage.

Cotton comprises one-half the crops, fresh lands yielding nearly one bale per acre. The height to which the plant grows varies from 6 inches to 3 feet, a medium being most productive. The use of fertilizers favors bolling and prevents running to weed. After fifteen years' cultivation the yield is about 400 pounds of seed-cotton per acre. Indigo- and hog-weeds are most troublesome.

The *mulatto soils* differ but little in character from the gray. Cotton seems to come to maturity, but does not open until the frosts crack the bolls, and it is then too much damaged to bring a fair price in market. The subsoil is a heavy clay, and the land is hard to cultivate.

Shipments are made by railroad, via Sparta, to Augusta, immediately upon baling.

PUTNAM.

Population: 14,539.—White, 3,518; colored, 11,021.

Area: 360 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 72,664 acres.—Area planted in cotton, 35,819 acres; in corn, 23,175 acres; in wheat, 2,855 acres; in oats, 2,881 acres; in rye, 93 acres.

Cotton production: 9,678 bales; average cotton product per acre, 0.27 bale, 384 pounds seed-cotton, or 128 pounds cotton lint.

Putnam county is hilly and rolling. Its streams all flow south and southeast, and unite with the Oconee river, which forms its eastern boundary.

A large proportion of the land is of a red clay or mulatto character, the gray sandy soils being found interspersed in large and small areas throughout. The rocks forming these lands are mostly biotite gneisses, with some granites and mica-schists. Hornblendic gneisses occur north of Dennis' station.

Very little of the surface of the county is too hilly for cultivation; 2½ per cent. is too swampy. The lands under cultivation, comprising 31.5 per cent. of the county area, are devoted to cotton, corn, wheat, oats, potatoes, etc.

Cotton is the chief crop, its acreage being 49.3 per cent. of the tilled lands, and averaging 99.5 acres per square mile. Its average product per acre is very low.

The following result of an experiment with fertilizers by J. T. Dennis, of Eatonton, is reported:

Mulatto land that had been lying turned out twenty-five or thirty years and had grown up in old-field pines was used. Original growth, oak and hickory. Average yield, without fertilizers, 463 pounds per acre; yield with 200 pounds of fertilizers, per acre, from 630 to 910 pounds of seed-cotton.

ABSTRACTS FROM THE REPORTS OF ROBERT C. HUMBER AND J. T. DENNIS, OF EATONTON.

The lands are nearly all of a uniform character, comprising deep-red clay, light gray, and light sandy pine lands.

The *deep-red clay lands* cover from three-fourths to four-fifths of the surface of the county, and extend 30 miles north and 20 south, and across the county east and west. The soil has a depth of 2 feet, and has a heavier red-clay subsoil, that bakes very hard after summer rains and is very clammy, absorbing moisture readily when pulverized. The growth is oak, hickory, ash, poplar, and pine. The lands are best adapted to cereals, though fully one-half is planted in cotton. Too much rain and too deep plowing cause the cotton-plant to run to weed. Its average height is 2½ feet. It yields about 1,000 pounds of seed-cotton per acre on fresh land, and 500 pounds after ten years' cultivation. In the latter the staple is much shorter, and 1,665 pounds of seed-cotton are required for 475 pounds of middling lint. Rag- and hog-weeds are most troublesome. Fully one-half of these lands now lies out. They produce well for the first two or three years when again taken in, but are much damaged by washing and gullying, and the valleys are injured to a considerable extent. Hillside ditching prevents damage, but the quickest and surest remedy is to plant Bermuda grass on the slopes.

The *light gray lands* suffer from rust. They comprise one-sixth of the area of the county, and have a growth of post oak and hickory. The subsoil is a light yellow clay, which is underlaid by clay. The greater part of the crops is of cotton, which grows to a height of 3 feet, and produces from 1,500 to 2,000 pounds of seed-cotton per acre on fresh land. Ten years' cultivation reduces this yield to 600 pounds. One-half of the land now lies out, being much damaged by washing away of the soil, and the sand damages the valleys very greatly. Hillside ditching meets with partial success.

The *light sandy pine soils* cover but a small area in the county. They are coarse sandy and gravelly, and of a whitish color. The bottom lands are sometimes injured by early frosts.

Cotton is either shipped to Savannah by railroad at 45 cents per 100 pounds, or to Milledgeville at 25 cents per 100 pounds.

BALDWIN.

Population: 13,806.—White, 4,512; colored, 9,294.

Area: 240 square miles.—Woodland, all; oak, hickory, and pine uplands, 12 square miles; sand hills, 138 square miles; metamorphic, 90 square miles.

Tilled lands: 61,464 acres.—Area planted in cotton, 27,832 acres; in corn, 17,599 acres; in wheat, 1,607 acres; in oats, 1,858 acres; in rye, 73 acres.

Cotton production: 7,921 bales; average cotton product per acre, 0.28 bale, 405 pounds seed-cotton, or 135 pounds cotton lint.

Baldwin county, one of the counties whose area embraces in part the metamorphic region on the north and in part the pine and sand-hills region on the south, has a rolling and hilly surface, drained by the Oconee river and its tributaries.

The metamorphic region reaches northward from Milledgeville, its rocks forming belts of gray sandy and red clay lands, all with red or yellow clay subsoils. A granite belt (pink feldspar) with gray sandy lands occupies its southern border, which has a width of several miles and extends northeast and southwest. Red clay lands, from (black mica) gneisses, cover large areas 4 miles north of Milledgeville. (See analysis, page 35.) From Milledgeville southward the pine hills, with their deep sandy soils and sand-beds, rise high above the metamorphic, and are covered with long- and short-leaf pine and an undergrowth of black-jack, with some other growth. Underneath the lands are heavy beds of white and variegated plastic and impervious clays.

It is thought that 62 per cent. of the original growth of the county has been removed. Tilled lands now comprise 40 per cent. of the county area, and are devoted to cotton, corn, small grain, potatoes, etc. Cotton is the chief crop, and averages 116 acres per square mile (45.3 per cent. of tilled lands), the county ranking eighth in the state in this regard. Its product per acre is, however, small. There is a large cotton factory in the county. (For experiment of Hon. F. C. Furman with fertilizers on worn-out land, see page 58.)

The following description of the region around Milledgeville is taken from "A visit to the United States", by Sir Charles Lyell, 1846:

It is striking, around Milledgeville, to see so many large detached and rounded bowlders of granite lying on the surface of the soil and all strictly confined within the limits of the granite region. One of these, on the slope of a hill 3 miles from the town, resting on gneiss, measured 12 feet in its largest diameter, and was 4 feet high.

The surprising depth of some of the modern ravines in the neighborhood of Milledgeville suggests matter of curious speculation. At the distance of 3½ miles west of the town is a ravine. Twenty years ago it had no existence, but when the trees of the forest were cut down, cracks 3 feet deep were caused by the sun's heat in the clay; and during the rains a sudden rush of water through these cracks caused them to deepen at their lower extremities, from whence the excavating power worked backward, till, in the course of twenty years, a chasm measuring no less than 55 feet in depth, 300 yards in length, and varying from 20 to 180 feet in width was the result. In the perpendicular walls of this great chasm appear beds of clay and sand, red, white, yellow, and green, produced by the decomposition, *in situ*, of hornblendic gneiss, with layers and veins of quartz, and of a rock consisting of quartz and feldspar.

ABSTRACT FROM THE REPORT OF JAMES C. WHITAKER, OF MILLEDGEVILLE.

The lands of the county may be classed as light sandy uplands, with clay subsoil, and light isinglass (mica) lowland soils.

The *light sandy soil* comprises three-fourths of the lands of the county, and has a growth of pine, with scrub black oak and dogwood. The crops of the county, besides cotton, are oats, corn, and wheat, and this land is best adapted to the first two. Ten per cent. of the land now lies out, and produces well when taken in again if manure is used. The uplands are seriously damaged by washing, but the valleys are not injured. But few efforts are made to check the damage, hillside ditching meeting with poor success. One-half of the crops is of cotton, which grows to a height of 3½ feet, and yields 700 pounds of seed-cotton per acre, or an average of 200 pounds of lint, which rates as middling. After ten years' cultivation the land yields only 500 pounds of seed-cotton, the staple then being low middling. Crab-grass is most troublesome.

The *bottom lands* of the Oconee river are narrow in the upper part of the county, but widen out to the south, with a heavy growth of cottonwood, ash, and maple, and an undergrowth of cane. The soil is a light sandy, yellowish loam on the river and a dark mucky sand on the creeks, very deep, and well adapted to corn. It is warm, but ill drained, and is easily tilled. Cotton forms one-half of the crops, growing to a height of from 5 to 6 feet, producing 1,200 pounds of seed-cotton when fresh. It is improved by ten years' cultivation, its yield increasing to 1,500 pounds. The staple is not, however, as good as on fresh land, being stained by lateness of the seasons. Burr-weeds are most troublesome on these bottom lands.

Shipments are made, as fast as cotton is ginned, to Savannah, by rail, at 40 cents per 100 pounds.

JONES.

Population: 11,613.—White, 3,753; colored, 7,860.

Area: 470 square miles.—Woodland, all; sand hills, 55 square miles; metamorphic, 415 square miles.

Tilled lands: 70,928 acres.—Area planted in cotton, 29,820 acres; in corn, 22,464 acres; in wheat, 2,685 acres; in oats, 3,010 acres; in rye, 147 acres.

Cotton production: 8,297 bales; average cotton product per acre, 0.28 bale, 396 pounds seed-cotton, or 132 pounds cotton lint.

Jones county in its agricultural features belongs in part to the metamorphic and in part to the pine and sand-hills region, the railroad from Macon to Milledgeville, in its route through this county, nearly marking the line of separation between the two regions. In some of the excavations along its line the white kaolin and variegated clays, as well as fossil-shell beds (at Smith's summit) of the central cotton belt, are exposed, while at a very short distance north of the railroad, and sometimes penetrated by it, are the granites and gneisses, either as solid rock or in a state of disintegration. This metamorphic division is hilly, 2 per cent. being said to be too broken for successful tillage. Pink feldspathic granite forms a belt in the lower part of this metamorphic area.

The lands south of Clinton are very generally red and clayey from hornblendic gneisses. Northward the gray sandy soils, with their clay subsoils, prevail, covering a belt several miles in width. Small areas of red lands are interspersed throughout the section, and a wide belt is found crossing the northwestern corner of the county.

The southeastern portion of Jones, covered by the pine hills and gray sandy lands, is underlaid largely by the white and variegated clays.

Smith's summit, a high point on the railroad, shows the following section in the railroad cut: 12 feet, red sandy clay under the soil; 8 inches, joint clay; 3 feet, joint clay, with fossil-shell casts; 6 feet, joint clay containing shells and a stratum of calcareous nodules filled with a yellow rotten clay. "Quicksand" is found below this at 6 feet depth.

The hills are capped with red clay, and a few miles southeastward is found the siliceous shell-rock similar to that near Macon.

As is usual in the metamorphic region, the bottom lands along the streams are narrow, though very rich. The uplands are chiefly devoted to cotton culture. One per cent. of the county is said to be irreclaimable swamp, and 2 per cent. is too hilly for tillage. The lands under cultivation in this county embrace 23.6 per cent. of its area, and are devoted to cotton, corn, small grain, potatoes, etc. Cotton is the chief crop, and has an acreage of 63.4 acres per square mile, or 42 per cent. of the tilled lands.

Macon is the market for the county, cotton being hauled in wagons.

BIBB.

Population: 27,147.—White, 11,429; colored, 15,718.

Area: 240 square miles.—Woodland, all; sand hills, 119 square miles; metamorphic, 121 square miles.

Tilled lands: 52,179 acres.—Area planted in cotton, 20,724 acres; in corn, 14,325 acres; in wheat, 748 acres; in oats, 4,101 acres; in rye, 44 acres.

Cotton production: 5,858 bales; average cotton product per acre, 0.28 bale, 405 pounds seed-cotton, or 135 pounds cotton lint.

Bibb county is divided into two unequal parts by the Ocmulgee river. The county is also situated on the line between the metamorphic and pine-hills belts, the largest area being in the latter.

The city of Macon marks the northern limit of navigation on the river, and also the southern limit of the metamorphic or mineral region in the county. Shoals are formed in the bed of the stream here by the outcropping rocks of the last-named region, while immediately north of the city the same rocks outcrop on the uplands.

East Macon, or that part on the east side of the river, is situated on the clays of the pine-hills belt, which are also found northeastward toward Milledgeville. The siliceous shell-rock or buhr-stone of the lower country is found in this section at Artape's quarry, and white coral limestone is found at Brown's mount and at other points.

On the southwest the metamorphic line extends toward Knoxville, in Crawford county; and southward from this line, and covering the largest part of the county, are the pine hills.

The metamorphic section of the county is hilly and broken, with gray gneiss outcrops for a few miles northwest of Macon; hornblendic rock and a little trap are then associated with it. The soils of this northwestern section are red, mixed with gray sands in patches and small areas. The red often caps the hills and covers the highlands, while the valleys are of a mulatto color—a mixture of the gray sandy and red soils.

The southern part of the county is hilly, and is covered with deposits of drift sands and clays with rounded pebbles, a growth of large pine, and an undergrowth of black-jack and some water oak.

Seven miles south of Macon are red hills, 75 feet above the valleys, showing 25 feet of white clays under the 50 feet of red clay. The bed of white marl lying between the white and red clays in Crawford county does not appear here.

The red-clay hills extend northeast through the county, and underlying the clays are frequently found beds of silicified fossil shells (Tertiary). It is thought that about 75 per cent. of the original timber growth has been removed, and that 10 per cent. is of irreclaimable swamp. Thirty-four per cent. of the county area is under cultivation in cotton, corn, oats, wheat, pease, and sweet potatoes. Cotton is the chief crop, with an average of 86.4 acres per square mile, or 39.7 per cent. of tilled lands. Its average product per acre is low.

W. D. H. Johnson, of Holston, reports an experiment on a sandy loam soil that had been in cultivation for 40 years:

Soil, 12 inches deep with a red-clay subsoil; land well supplied with humus. Original growth, oak and hickory. The results reported are: Yield, without fertilizers, 527 pounds per acre; with 200 pounds commercial fertilizers, about 760 pounds of seed-cotton.

Macon, the railroad center of this part of the state, is the market for many of the adjoining counties. It contains two cotton factories which consume a part of the cotton marketed there.

ABSTRACT FROM THE REPORT OF W. D. H. JOHNSON,(a) OF BOLINGBROKE.

The lands of the county may be classed as dark mulatto, gray sandy, and red clay.

The *mulatto and red lands* have a growth of oak and hickory. The soil is from 1 inch to 10 inches deep, and has a stiff red-clay subsoil. The lands are early, warm, ill drained, and easy to till, producing good crops of corn, cotton, oats, wheat, pease, and potatoes, but are best adapted to cotton, which grows to a height of 3 feet, running to weed in excessive wet weather in August. The plant yields on fresh land 1,000 pounds of seed-cotton per acre, but only 700 pounds after 5 years' cultivation. Crab-grass alone is troublesome. Two-thirds of this land now lies out. When taken in again it is as good as new for the first three or four years. The uplands are much injured by the washing of the soils, but the valleys are benefited 50 per cent. Hillside ditching is resorted to in order to check the damage.

The *gray sandy lands* have also a growth of oak and hickory. The soil has a depth of 12 inches over a yellow gravelly subsoil. It is late and warm, easy to cultivate, and is best adapted to cotton, which grows to a height of 2 or 3 feet, and produces 1,200 pounds of seed-cotton when fresh and 800 pounds after 5 years' cultivation. One-third of these lands now lies out, and does not produce well when again taken into cultivation. The lands wash readily, doing serious damage, and ruining the valleys by the heavy deposit of sand. Hillside ditching and horizontalizing are not effectual in checking the damage.

Cotton is shipped, as fast as ginned, by wagon to Macon.

JASPER.

Population: 11,851.—White, 4,258; colored, 7,593.

Area: 380 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 87,203 acres.—Area planted in cotton, 27,606 acres; in corn, 23,303 acres; in wheat, 4,649 acres; in oats, 2,687 acres; in rye, 33 acres.

Cotton production: 6,741 bales; average cotton product per acre, 0.24 bale, 348 pounds seed-cotton, or 116 pounds cotton lint.

Jasper county differs but little from the counties around it. The country is undulating on the north and rolling or hilly on the south, a dividing ridge between the Ocmulgee and Oconee tributaries lying near the central north and southern portion of the county.

The lands of that part of the county north of Monticello are mostly dark gray and sandy, with yellowish clay subsoils, and are formed from mica-schists and gneisses, the former having quartz seams somewhat gold-bearing. Mulatto and red lands are interspersed throughout the section. These uplands are generally well drained into the Ocmulgee river on the west and the Oconee on the east. The lands on the south of Monticello are for the most part a red clay, the soil being more or less sandy. They extend to the county-line on the south, and are formed chiefly from hornblendic rocks.

Lands under tillage embrace 39.5 per cent. of the county area, and 3½ per cent. are said to be too broken and 1⅛ per cent. too swampy for cultivation. Cotton is the chief crop (31.7 per cent. of tilled land), with an acreage averaging 72.6 acres per square mile. The average product per acre is extremely low.

a Secretary of the Ocmulgee Farmers' Club.

ABSTRACTS FROM THE REPORTS OF WILLIS NEWTON, OF SHADY DALE, AND WILLIAM D. MADDOX, OF MONTICELLO.

The lands may be classed as bottoms, gray sandy glades, and red and mulatto. On bottom lands the cotton is late in growing, inclines to run to weed, is liable to rot and to overflow, and is late in maturing. The gray or mulatto uplands are preferred, as on them cotton matures quickly, is more prolific, and retains its fruit, and it is not subject to as many disasters as on bottom or red lands.

The *gray lands* are of two classes, viz, a dark gray sandy loam (principal growth post oak) with a stiff clay subsoil, and a light gray soil with a clay subsoil, not so productive. The first of these is the chief cotton land of the county, two-thirds of the crops being cotton. The soil is only 2½ or 3 inches deep, and is early and cold, but easy to till. The yield on fresh land is about 1,000 pounds of seed-cotton per acre, or 800 pounds after ten years' cultivation, 1,485 pounds from either making 475 pounds of lint. Crab-grass is most troublesome. The growth is post, red, Spanish, and white oaks, hickory, poplar, pine, dogwood, haw, and gum. One-third of the land lies out, but when again reclaimed it is nearly as productive as at first, and even more productive if fertilized. Horizontalizing is practiced with great success in preventing the washing of the hillsides, from which these gray uplands and valleys suffer.

The *mulatto or chocolate lands* are the next in importance as cotton lands, and are also well adapted to grain. They are found in sections containing from 1,000 to 5,000 acres each, and have a native growth of oak, hickory, poplar, and pine. The soil, a clay loam, is 2½ inches deep, has a stiff gravelly subsoil, and is difficult to till in wet weather. In all other respects, including productiveness, it resembles the gray lands.

The *glade lands*, also covering but a small area, have a growth of black-jack, post oak, and haw bushes. The soil is a coarse gravelly clay loam, 2 inches deep, with a yellow clay subsoil, and is best adapted to corn, though one-half is planted in cotton, and its yield is 1,200 pounds on fresh lands and 500 after ten years (unmanured). One-half of the land lies out; it washes readily, doing serious damage, but no efforts are made to check it.

The *red and stiff lands*, with a growth chiefly of oak, hickory, chestnut, poplar, and pine, have a depth of 4 inches and a red or yellow subsoil. The soil is early and well-drained, difficult to till in wet and easy in dry seasons, and is best adapted to grain. Of the crops planted on this land one-half is cotton. It grows to a height of 3 feet, and yields on fresh land about 800 or 1,000 pounds of seed-cotton per acre, 1,545 pounds being required to make 475 pounds of lint. Ten years' cultivation reduces the yield to 500 or 700 pounds, and the staple is not so good. Crab-grass also gives much trouble. About one-third of this land now lies out; it does not recuperate as rapidly as the gray, and when fertilizers are used it yields from 600 to 800 pounds of seed-cotton per acre. These uplands wash readily, doing serious damage and injuring the valleys 25 per cent. Hillside ditching and horizontalizing meet with only partial success in checking the damage.

Shipments of cotton are made to Madison or Eatonton by wagon, and thence by railroad to Savannah or to Augusta.

BUTTS.

Population: 8,311.—White, 4,277; colored, 4,034.

Area: 180 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 49,090 acres.—Area planted in cotton, 20,755 acres; in corn, 15,880 acres; in wheat, 4,135 acres; in oats, 2,254 acres; in rye, 37 acres.

Cotton production: 6,829 bales; average cotton product per acre, 0.33 bale, 468 pounds seed-cotton, or 156 pounds cotton lint.

The surface of Butts county is generally rolling, with much level area. Granitic lands are found on the northwest, and a ridge of red land from biotite granite extends from Flat shoals, on the Towaliga river, to Key's ferry, just below the junction of the South river with the Ocmulgee. Another ridge, formed from masses of quartz-rock, passes from High falls northeastward to and beyond Indian springs, a noted place of summer resort. With the exception of the narrow red belt mentioned the lands are almost entirely gray and sandy.

In the granitic section the rocks are usually found in fragments, though large areas are sometimes found covered with masses of granite in which the feldspar is found in coarse crystals. The ridges are often very sandy.

One per cent. of the area of the county is said to be too broken and 2 per cent. too swampy for successful tillage. Forty-five per cent. of the original timber growth is thought to have been removed. The county is drained eastward into the Ocmulgee river, the eastern boundary.

Lands under tillage embrace 42.6 per cent. of the area, and are devoted to cotton, corn, small grain, potatoes, etc.; 42.3 per cent. of these lands are in cotton, which averages 115.3 acres per square mile, the county ranking as ninth in the state in this regard.

Cotton is hauled to Griffin or other railroad stations, and thence sent to market or sold off of the wagons to local buyers.

MONROE.

Population: 18,808.—White, 6,693; colored, 12,115.

Area: 470 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 106,673 acres.—Area planted in cotton, 44,979 acres; in corn, 29,884 acres; in wheat, 6,742 acres; in oats, 6,765 acres; in rye, 246 acres.

Cotton production: 13,354 bales; average cotton product per acre, 0.30 bale, 423 pounds seed-cotton, or 141 pounds cotton lint.

The surface of Monroe county is rolling, but not too much so for successful tillage. It gradually falls in elevation to the east and southeast, having an altitude of 875 feet on the railroad on the west, 735 feet at Forsyth, and 625 feet at Prattsville. Its drainage is to the Ocmulgee river, the eastern boundary. A broad belt, in which prevail red clay lands, from hornblendic rocks and gneisses having black mica, passes diagonally through the central portion of the county, while on either side the lands are chiefly gray and sandy. The county on the northwest is generally granitic in character, with predominating gray lands, though there are large areas of red soils, from the decomposition of the black mica, which enters largely into the composition of the rock. Quartz fragments are also abundant on the surface. On the southeast hornblendic gneiss, associated with the gray gneisses, occurs abundantly, and the red and gray lands are very much intermixed. (See analysis of soil, page 35.)

The lands of the water-courses have a rich, dark, chocolate-colored soil, and are well timbered. Tilled lands embrace 35.5 per cent. of the county area, and of these 42.2 per cent. are devoted to cotton, the chief crop. Cotton thus has an average of 95.7 acres per square mile, though in actual acreage for the entire county (44,97 9) the county ranks as seventh in the state. On the other hand, in product per acre it is extremely low (423 pounds of seed-cotton), there being 85 counties whose average each is greater.

ABSTRACT FROM THE REPORT OF R. C. M'GOUGH, OF FORSYTH.

There are in this county many varieties of upland soil, from deep stiff red to light sandy loam. The lowlands (unless largely intermixed with sand) are not well adapted to cotton, which grows luxuriantly but matures very slowly. The area covered by these lands is very limited, and is usually devoted to corn or oats. The uplands seldom fail in producing good crops.

The *light sandy lands* cover one-half the county area; soil, 6 inches deep. The subsoil is a very tenacious and impervious red clay, sometimes yellow, containing hard, white gravel and rounded pebbles of hardened clay or sandstone, and underlaid by gravel and quartz at from 1 foot to 15 feet. The lands are easily tilled in wet and dry weather when well prepared and manured. They are late and cold unless well drained, producing crops of cotton, corn, wheat, oats, rye, sweet potatoes, and pease, but are best adapted to cotton, oats, and potatoes. Cotton, comprising two-fifths of the crops planted, grows 3 or 4 feet high when manured, and runs to weed from excessive rains unless prevented by the use of superphosphates and nitrogenous manures. The yield of these lands when fresh is from 600 to 1,000 pounds of seed-cotton per acre, and the same after ten years' cultivation if any care has been bestowed on them. The staple is the same on both old and fresh land, the buyers making no difference in prices. Hog-, carrot-, or rag-weeds, and especially crab-grass, are the greatest source of trouble. About one-tenth of these lands now lies out; when again cultivated it produces better than the original soil. The lands do not wash readily, except in some sections, where serious damage is done to hillsides, and the valleys are improved. By deep plowing, heavy manuring, and building stone dams across the hollows, the damage is successfully checked. The growth of these gray lands is oak, hickory, short-leaf pine, chestnut, poplar, beech, sweet gum, etc.

The *red lands*, comprising something less than one-half the area of the county, have a growth of the various kinds of oaks, hickory, buckeye, chestnut, walnut, etc. The soil is a yellow or red clay loam, with sometimes coarse, red sand (alternating with gray), from a few inches to several feet deep; the subsoil is much the same, but underlaid at a depth of 10 or 12 feet by a thick bed of loose, gray earth, with no adhesive properties, called "well dirt", porous and leachy, with many perennial springs. The soil contains large and small pebbles, from the disintegration of the granite, which is sometimes found at a depth of from 5 to 30 feet. The land is difficult to till, in wet weather being sticky and in dry seasons very hard and compact. It is, however, early, warm, and well drained, and best adapted to corn and wheat. One-third is planted in cotton, which grows to a height of from 1 foot to 2 feet without manure, the higher the better, and runs to weed in long, continuous wet seasons. Early planting with nitrogenous manures and rapid work facilitate bolling. Crab-grass and poverty-weed, or stone-clover, are the troublesome weeds. Three-fourths of the red lands now lie out. They wash so readily and so much damage is done that they are seldom reclaimed. The yield in seed-cotton is 1,000 pounds on fresh lands, and from 100 to 400 pounds after twenty-five years' cultivation. About 1,500 pounds are required to make 475 pounds of lint, and no difference is made in the staple.

There is a *light sandy loam*, 10 inches in depth, with a heavier subsoil, that accompanies the gray lands, but occupies very narrow limits. It has more poplar, "big-bud" hickory, and ash than is found on other soils. Cotton does well on this land, retaining its fruit better, and yielding from 800 to 1,000 pounds of seed-cotton per acre. Crab-grass is troublesome. None or very little of the land lies out, and is not much injured by washing.

Cotton is sold in Forsyth as fast as ginned, and from there shipped by the Central railroad to Savannah and to Atlanta.

PIKE.

Population: 15,849.—White, 7,780; colored, 8,069.

Area: 290 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 93,620 acres.—Area planted in cotton, 38,755 acres; in corn, 29,243 acres; in rice, 7 acres; in oats, 5,596 acres; in wheat, 7,510 acres; in rye, 136 acres.

Cotton production: 12,431 bales; average cotton product per acre, 0.32 bale, 456 pounds seed-cotton, or 152 pounds cotton lint.

The surface of Pike county is rolling and broken in places, though there is very little that does not afford excellent lands for cultivation. It is well watered by the tributaries of Flint river, its western boundary, and by Big Potato creek, which flows southward through the county.

The greater part has been cleared, and now more than one-half of the entire area is in cultivation. The average of lands under tillage is 322.8 acres per square mile, an average greater than in any other county of the state.

The lands are the usual metamorphic varieties, dependent upon the character of the rocks, and differing from each other within small areas. They embrace soils more or less clayey and red to great depths and gray sandy or gravelly soils, the subsoil of which is a yellow or reddish clay at a depth of from 6 to 10 inches from the surface. A large region of red and excellent farming lands, derived mostly from hornblendic rocks, occurs on the west, between Big Potato creek and Flint river, reaching from the northern part of the county south through Upson county. It is largely under cultivation, and is thought to be best adapted to grain, though a large percentage is devoted to the culture of cotton, the yield in good seasons being from 600 to 800 pounds of seed-cotton per acre.

The lands of the rest of the county are mostly gray sandy and gravelly, sometimes very rocky, with reddish clay subsoils, timbered with oak and hickory. They are best suited to cotton, and yield an average of a third of a bale, or 500 pounds of seed-cotton, per acre; but in good seasons the yield is often as much as 800 pounds. These lands are derived from granite and gneisses, the former being the prevailing rock on the northwest, where it appears in numerous outcrops, giving to the country a broken and somewhat hilly character, and on the northeast, where it graduates into the gneisses of the rest of the county, the surface is more level. Black or biotite mica enters largely into the composition of these rocks.

The chief crops of the county are cotton, corn, wheat, and oats. Cotton has the largest acreage, and comprises 41.4 per cent. of the lands in cultivation, and averages 133.6 acres per square mile. This average is exceeded in the entire list of counties only by Troup, which has 153.9 acres per square mile. Its corn acreage is 100 acres, and its wheat about 26 acres per square mile.

UPSON.

Population: 12,400.—White, 6,133; colored, 6,267.
Area: 310 square miles.—Woodland, all; metamorphic, all.
Tilled lands: 72,475 acres.—Area planted in cotton, 30,551 acres; in corn, 23,143 acres; in wheat, 6,751 acres; in oats, 3,205 acres; in rye, 23 acres.
Cotton production: 8,540 bales; average cotton product per acre, 0.28 bale, 399 pounds seed-cotton, or 133 pounds cotton lint.

The surface of Upson county is hilly or rolling and in places rather undulating, the drainage of the greater part being to the Flint river, on the western boundary. The Flint and Ocmulgee divide passes through the northeastern part of the county. There are low ranges of mountains on the northwest, which are a continuation of the Pine and Oak mountains of Meriwether and Talbot counties, but here turn northward, their sandstones forming gray sandy lands. Through Thomaston and northeastward along the line of the railroad the level uplands are formed by granites. The lands are mostly gray on this upland, while between it and the mountains red lands are most prominent.

On the south from Thomaston there is a large area of sandy pine lands, but over the rest of the county, east and southeast, the red soils form the largest proportion of the lands, interspersed with gray sandy areas. It is said that 2 per cent. of the county area is too hilly for tillage.

Tilled lands comprise 36.5 per cent. of the surface of the county, and of these 42.2 per cent. are in cotton, the chief crop, averaging 98.6 acres per square mile.

ABSTRACTS FROM REPORTS FROM THOMAS J. MIDDLEBROOKS, OF BARNSVILLE, AND E. W. ROSE, OF "THE ROCK" POST-OFFICE.

The gray sandy and red lands of the county are devoted chiefly to cotton, the red soils having been worn greatly by previous cultivation and thus fitted for its successful production. The crops of the county are cotton, wheat, and corn. Both uplands and bottoms may be planted in cotton with but little danger of loss by frosts. It is, however, best to use some fertilizer on bottom lands for surety.

The *gray lands* have a growth of pine, hickory, black-jack, post, and white oaks. The soil varies from a fine to coarse sandy and gravelly, from 4 to 10 inches in depth, with a yellow subsoil, changing to a fine and heavy red clay below. The soil is late, cold, well drained, and easily tilled, and is best adapted to cotton, though when fresh it is good corn land. Of all the lands in cultivation one-half is devoted to cotton. This grows to a height of from 2 to 3 feet, and runs to weed on fresh pine-woods land, which is checked by deep culture and the use of ammoniacal manures. Its yield is from 600 to 800 pounds of seed-cotton per acre on fresh land, and from 400 to 500 pounds after five years' cultivation of good land. The staple is larger and better from fresh land, 1,485 pounds from fresh and 1,722 pounds from old lands making 475 pounds of lint. Rag-weeds are the most troublesome. Not more than 10 per cent. of these gray lands now lie out. They produce well when taken in again and cultivated with fertilizers. These uplands do not wash readily, and but little damage is done either to them or to the valleys.

The *red lands* have a growth of oak, hickory, chestnut, poplar, etc., a depth of from 8 to 10 inches, and a fine stiff clay subsoil, somewhat impervious to water. The soil is early, warm, well drained, and best adapted to corn and wheat unless long under cultivation, when cotton does well. One-third is planted in cotton; it grows to a height of 2½ feet, and runs to weed only on fresh land. It yields from 600 to 800 pounds of seed-cotton per acre on fresh lands, and 400 pounds after ten years' cultivation, the staple then being inferior. Rag- and hog-weeds are most troublesome. About 10 per cent. of the red land now lies out, and after a few years' rest produces moderately well if gullying is prevented. The lands do not wash very readily, and no serious damage is done unless neglected and allowed to gully in course of time. The valleys and bottoms are ruined sometimes by the washing from the uplands. We have an abundance of material on hand to fill up all the gullies, and it pays to use it.

Cotton is either sold at Thomaston, or shipped thence to Savannah.

CRAWFORD.

Population: 8,656.—White, 3,940; colored, 4,716.
Area: 340 square miles.—Woodland, all; sand hills, 161 square miles; metamorphic, 179 square miles.
Tilled lands: 53,531 acres.—Area planted in cotton, 24,754 acres; in corn, 16,737 acres; in wheat, 2,040 acres; in oats, 2,688 acres; in rye, 46 acres.
Cotton production: 6,765 bales; average cotton product per acre, 0.27 bale, 390 pounds seed-cotton, or 130 pounds cotton lint.

Through Crawford county passes the southern limit of the metamorphic region of the state, Knoxville, the county town, being on this line. In a branch in the southern edge of the town is an outcrop of gray gneiss. From that point to the Houston county-line the country is covered with the sands and clays of the pine hills.

The entire surface is hilly and rolling, the Atlantic and Gulf water-divide passing in a southerly course through its center. Flint river forms a part of the western boundary.

The lands of the metamorphic area of the county are gray and gravelly, interspersed with red clay belts and tracts, and underlaid by clay subsoils. A belt of cold, gray clay lands, from clay-slates, occurs along the border of the region, forming high banks on the east side of Flint river.

The red clay hills of the central cotton belt are represented in the county by a small area at Rich Hill, a few miles southeast of Knoxville. This hill has an elevation of 100 or more feet above the level of the country, its summit being of red sandy clay, 50 feet in thickness. Under this are 6 or 8 feet of joint clay, 35 feet of white coral limestone, and finally a white joint clay, 50 feet of which is exposed in a deep gully.

The rest of the county on the south of Knoxville is covered by the sands of the pine hills, white and deep on the hill-tops, with gray soils in the lowlands, in which the underlying white clays outcrop occasionally. Nearly one-fourth (24.6 per cent.) of the county is under cultivation, and 40 per cent. is said to have been cleared of its original timber growth. Cotton, corn, wheat, and oats are the crops of the county. Cotton, the chief crop, has an average of 72.8 acres per square mile, or 46.2 per cent. of the tilled lands. Its product per acre is very low.

ABSTRACT FROM THE REPORT OF R. LE SNEUR, OF KNOXVILLE.

The following soils are distinguished in the county, viz: First and second bottoms on the river and other streams; (2) red and yellow lands; (3) sandy soils of the pine hills. The *sandy pine hills soil* is the chief one. It is best adapted to oats as a general thing, though three-fifths of the crops are of cotton. Two-fifths of the county is of this sandy land, which has a growth of short- and long-leaf pine, red, white, water, and post oaks, hickory, ash, elm, poplar, etc. The depth to the white and variegated colored clays is from 3 inches to 3 feet, giving lands well and ill drained but easy to cultivate. Cotton grows to a height of from 1 foot to 6 feet, yielding at 4 feet 500 pounds and upward of seed-cotton per acre on fresh lands, with low middling lint. Cultivation of ten years reduces this yield to 300 pounds, and in some localities even more is produced without manure. Light crops have resulted usually from exhausted and poor lands and indifferent cultivation.

Both valleys and uplands are injured by the washing away and gullying of the latter, and but slight efforts have been made to check the damage, which amounts to 10 or 15 per cent.

One-third of the lands now lies out. The crops are much troubled with crab-grass, morning-glory, hog-weed, rag-weed, etc.

Cotton is shipped by wagon to Macon at 50 cents per 100 pounds.

TAYLOR.

(See "Central cotton belt".)

TALBOT.

Population: 14,115.—White, 4,448; colored, 9,667.

Area: 360 square miles.—Woodland, all; sand hills, 74 square miles; metamorphic, 286 square miles.

Tilled lands: 74,037 acres.—Area planted in cotton, 36,310 acres; in corn, 25,696 acres; in wheat, 3,882 acres; in oats, 3,652 acres; in rye, 82 acres.

Cotton production: 10,325 bales; average cotton product per acre, 0.28 bale, 405 pounds seed-cotton, or 135 pounds cotton lint.

Talbot county has for its most prominent features a mountainous region on the north, a rolling and broken county with gray and red lands southward beyond Talbotton, the pine-hills region on the south, and through the county from the north to the pine hills the broad trap dike, extending in a direct line between the chalybeate springs of Meriwether to Talbotton and southward to a point not far from Geneva.

Pine mountain, on the north, along which the county-line runs, is about 325 feet above the valley; Oak mountain, lying parallel, is 135 feet high. Both are of sandstone, which dips in opposite directions (anticlinal), and have narrow summits. Between them is the broad valley already mentioned in Harris county. It is here broader, and with perhaps more red lands than in Harris. The rocks forming the soils are hornblendic granites (syenites) with quartz ridges or "burst-ups" and gneisses.

South of Oak mountain there are hills of varying heights, which give to the county a rough or broken character. On the east the lands are chiefly red clays, from decomposed hornblendic rocks and granites, and have a width of about 3 miles, and lie parallel with Oak mountain; but on the west and south gray sandy or mulatto lands predominate. These lands have the usual red and yellow clay subsoils. Granite accompanies the trap dike throughout in this section south of the mountains. The mass of trap-rocks is so dense as to leave no tillable land within the belt, and the rocks are used largely for building fences. They disintegrate very slowly.

The sands and variegated clays of the pine hills, besides covering all the lower part of the county, form low ridges between the streams northward for some miles.

On the hill at Geneva, and also in a greater mass on the southeast in the bed of a creek, is found a cemented mass of gravel, white clay, and mica, or what seems to be a granite *débris*.

Six per cent. of the county area is said to be too broken and 2¾ per cent. too swampy for successful tillage. Lands under tillage embrace 32.1 per cent. of the county area, though 70 per cent. of the original timber growth is said to have been removed. Cotton is the chief crop (49 per cent. of tilled lands), having an average of 100.9 acres per square mile, the county ranking as seventeenth in the state in this regard.

ABSTRACTS FROM THE REPORTS OF W. M. GORMAN, OF GENEVA, AND WILLIAM H. ELLISON, OF SHILOH, HARRIS COUNTY.

The lands of Talbot county may be classed as gray post-oak uplands, red lands (including mulatto), and light sandy bottom.

The *gray lands* have a gravelly soil 6 inches deep, a bright-red clay subsoil, crumbling when exposed to the air for a length of time, and a growth of post oak, hickory, and poplar. Cotton comprises half the crops, grows to a height of from 3 to 5 feet, and yields from 800 to 1,000 pounds of seed-cotton per acre on fresh land. Ten years' cultivation (unmanured) reduces this to 300 or 500 pounds, 1,545 pounds from old land making 475 pounds of lint, rating as good middling for the first, but inferior for the last. Crops are troubled with rag- and hog-weeds. More than one-half of these lands originally under cultivation now lies out. After a long rest they produce very well for four or five years. The uplands and valleys are both much injured by the washing of the upland soils unless well ditched, and even this is only partially successful in checking the damage.

The *red lands* occur in patches sometimes a mile or two in extent, and have a growth of hickory, poplar, red, and white oak. The soil is a red gravelly clay loam, 12 inches deep, with a sticky subsoil, which becomes hard when exposed. It is early when well drained and easy to cultivate in dry weather, and is best adapted to grain, though cotton is largely planted on it. The latter crop grows to a height of from 3 to 7 feet, and runs to weed when the land is new or the seasons are wet. Fertilizing and proper cultivation prevent this. It yields 600 or 800 pounds of seed-cotton per acre on fresh land and 300 or 400 pounds after ten years' cultivation. One-third of the land now lies out. The uplands and valleys are both injured very materially by the washing of the upland soil, but very little effort is made to check the damage.

The *creek bottoms* are usually very narrow and not much in cultivation. The growth is poplar, ash, white oak, willow, etc. The soil is a dark sandy loam, 2 feet in depth, and has a tough yellow clay subsoil. It is best adapted to corn and cotton, and is generally devoted to the former. There is not sufficient underdrainage for cotton, and therefore frequent rains, especially in July and August, cause it to shed and the bolls to rot. It is also more liable to the boll-worm and to be injured greatly by early frosts. It is only with a dry, late fall that the lowlands can be relied on. Cotton grows to the height of 8 feet on fresh land, and yields from 1,000 to 1,500 pounds of seed-cotton per acre, and the same after ten years' cultivation. The lint rates as good middling.

The *mulatto lands*, comprising a large part of the lands of the county, have a growth of various oaks, hickory, chestnut, poplar, pine, gum, and walnut. The soil, a fine sandy clay loam of various colors, has a depth of 12 inches, and a light to deep stiff red-clay subsoil. It is best adapted to grain, though one-half of the crops is of cotton. It yields 600 pounds of this latter crop per acre when fresh and 400 pounds after eight years' cultivation.

Shipments of cotton are made to Macon and to Columbus by railroad.

MERIWETHER.

Population: 17,651.—White, 7,797; colored, 9,854.

Area: 490 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 124,118 acres.—Area planted in cotton, 49,676 acres; in corn 35,842 acres; in wheat, 8,026 acres; in oats, 7,340 acres; in rye, 209 acres.

Cotton production: 15,154 bales; average cotton product per acre, 0.31 bale, 435 pounds seed-cotton, or 145 pounds cotton lint.

Meriwether county on the southeast is especially rough and hilly, a large section along the river from Pine mountain northward, via Red Bone, nearly to Woodbury, known as "the cove", being nearly impassable to wagons. Mineral springs occur along the foot of Pine mountain, the Chalybeate, Warm, and White Sulphur (not at the foot) being noted places of resort for the people of Columbus and other cities. Flexible sandstone is found near Warm Springs. The top of the mountain just southward has a very broad and level surface and a sandy soil.

Northward to Greenville the county is rolling and broken, the lands gray and sandy, with red clay soils in some places. There are granite outcrops just east of the White Sulphur springs.

Quartz gravel and rock in large quantities exist on these lands, derived from veins and seams in the mica-schists, which occur abundantly. Northwest of Greenville a granite belt is found passing westward into Troup county at Mountville, and another on the northeast, occupying the section between Line creek and the wagon-road leading from Location, in Coweta county, south to Flat Shoals. The rock forms large bowlders on the surface. Long-leaf pine is a prominent growth on the gray gravelly lands of the section.

On the northwest of the county a broad area or belt of red clay lands enters from Coweta county west of Grantville, and, passing in a southerly course to within 6 or 7 miles of Mountville, turns westward into Troup county. Hornblendic gneiss is the prevailing rock of this belt, and gold has been mined largely just east of it.

While the general surface of the county is rolling and broken, only 6 per cent. is too much so for cultivation, and large areas of level uplands are found in various sections; 78 per cent. of it is said to have been cleared.

Lands under tillage comprise 39.6 per cent of the area, and are devoted to corn, cotton, wheat, oats, rye, barley, potatoes, etc. Cotton is the chief crop (40 per cent. of tilled land), and has an average of 101.4 acres per square mile, ranking fifteenth in the state in this regard and fifth in the total number of acres in cotton.

ABSTRACT FROM THE REPORT OF J. E. G. TERRELL, OF GREENVILLE.

The soil is mostly ridge land or upland, and produces cotton well, and unless the early frosts are unusually severe the fruit all matures. The stalk is generally small, but because of its locality it fruits and matures well. The flat or low lands are in considerable amount and produce cotton well if a good fertilizer is used to make the bolls open well.

The *sandy and light uplands* comprise at least two-thirds of the area of the county, and alternate with small belts of red lands for 10 miles in every direction. The soil is coarse, sandy and gravelly, 14 inches deep, with a clay subsoil and a growth of oak, hickory, and pine. Cotton comprises one-half the crops, and grows 3 feet high. It runs to weed in wet springs and summers unless topped early in July and fertilized with guano, and produces from 600 to 700 pounds of seed-cotton on fresh lands per acre, or 300 to 350 pounds after years of cultivation, with a shorter and more brittle staple, and is most troubled with rag-weeds, "poor Peter," and May-pop vines.

One-fifth of the land now lies out, but produces well for three years when reclaimed with fertilizers. Much damage is done by the washing of the uplands, and the valleys are sometimes ruined. Hillside ditching is in some places a satisfactory means of preventing or checking the damage.

Cotton is hauled to La Grange and to other points on the Atlanta and West Point railroad for sale or shipment.

TROUP.

Population: 20,565.—White, 6,595; colored, 13,970.

Area: 430 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 129,046 acres.—Area planted in cotton, 66,188 acres; in corn, 38,677 acres; in wheat, 7,342 acres; in oats, 6,975 acres; in rye, 87 acres.

Cotton production: 18,655 bales; average cotton product per acre, 0.28 bale, 402 pounds seed-cotton, or 134 pounds cotton lint.

Chattahoochee river cuts off the northwest corner of Troup county, which is rough, broken, and quite hilly. Granites occupy the extreme corner, while southward from it are alternating ridges and belts of quartz, gneisses, and hornblendic rocks, with their respective rocky, gravelly, and sandy gray and red lands, the latter being prominent as far south as the road leading from La Grange to Fredonia, Alabama.

The surface of the country is broken and rolling, a line of narrow quartz ridges having a southwest trend occurring east of West Point and terminating in Alabama. The drainage of the county is entirely to the Chattahoochee river, on the west.

The most prominent feature of that part of the county east of the river is the deep red-clay land, a belt of which, several miles wide, extends from the northeast to and a little beyond La Grange, another small area lying northeast from West Point.

The main red region extends to Yellow Jacket creek, on the north, with narrow areas of gray lands. Gray soils, when found, are usually so thin that in plowing a mulatto variety is produced by the mixture of the underclay with them. These red lands are formed chiefly from hornblendic gneisses and syenites, the latter producing, by decomposition, the more clayey and deeper red soils. (See analysis, page 39.)

Along the southern line of the red belt there are outcrops of magnesian rocks, such as serpentine and soapstone. Near Mountville, on the east, these are accompanied by asbestus and chrome iron ore. Two miles north of West Point corundum and asbestus are found, with another outcrop of soapstone. Other localities of soapstone are on the west side of the river from La Grange, and on the Heard county-line not far from Corinth.

On the north of this belt are gray sandy hills, from the washings of which the wide bottom of Yellow Jacket creek has been covered with deep sand. They extend nearly to the Heard county-line, where red lands again predominate.

In the southeastern part of the county, embracing all lying south of a line from 3 miles north of Mountville to Flat Shoals creek, near West Point, the lands are gray sandy and gravelly, and are formed largely from gray biotite gneisses. Areas of red lands occasionally occur in this section, and in some places the rocks are garnetiferous.

Bordering this section on the northward is a belt of biotite granites, the rocks outcropping frequently in bowlders of very coarse material, accompanied by black tourmaline crystals. The soil is coarse and sandy. At Mountville the country is quite level, but becomes more broken on the southwest, until the belt terminates apparently with the quartz ridges near West Point already mentioned.

Tilled lands embrace 46.9 per cent. of the county area, an average of about 300 acres per square mile. It has, next to Pike and Houston counties, the largest percentage of tilled area in the state. Five per cent. of the area is said to be swampy, 3½ per cent. too broken for tillage, and 75 per cent. of the area cleared of its timber. Cotton is the chief crop, its average being 153.9 acres per square mile, or 51.3 per cent. of tilled land. In the former regard it ranks first in the state, in total acreage fourth, and in total bales fourth. Its product per acre is low.

ABSTRACTS FROM THE REPORTS OF DR. WILLIAM P. BEASLEY AND C. W. MABRY, OF LA GRANGE.

The soils may be classed as red clays, gray, or mulatto, and are all planted in cotton.

The *red lands* are the best, and cover about three-quarters of the area of the county, and especially of the uplands. They are interspersed with gray and mulatto soils, and have a growth of oak, pine, hickory, poplar, ash, black gum, buckeye, and chestnut. The soil has a depth of from 2 to 12 inches and a red-clay subsoil. Cotton comprises two-thirds of the crops, which grows from 1 foot, or "bumble bee size", to 5 feet high, and is inclined to run to weed when highly fertilized and when there is a great deal of rain while it is putting on fruit. It may be dwarfed or restrained by plowing close to the plant and cutting the lateral roots. On fresh land the yield is from 700 to 1,000 pounds of seed-cotton per acre; after eight to ten years' cultivation (unmanured), only 500 to 700, and after thirty years 300 to 400 pounds. The lint from old land is not as long as that from fresh land, but the seeds are lighter. The staple is classed as middling. Crab-grass is most troublesome to all crops. Old lands that have been lying out for a few years and have grown up in pines produce well for a few years if slightly fertilized. The hills are subject to washing or gullying, and sometimes the damage done is very serious to both uplands and valleys.

Those farmers who have tried terracing the hillsides prefer that method of checking the damage to all others. Dr. Beasley says: "Cotton production has greatly decreased within the last few years in this immediate section in spite of the reclaiming of old pine fields and the increased introduction and use of the various commercial fertilizers; and I am of the opinion that less and less will be produced here annually until our system of farming is radically changed and the soil has a chance to recuperate from the continued production regardless of rotation of crops."

Shipments are made to Atlanta, Savannah, and to New York.

HARRIS.

Population: 15,758.—White, 6,450; colored, 9,308.

Area: 470 square miles.—Woodland, all; metamorphic, all.

Tilled lands: 91,989 acres.—Area planted in cotton, 43,203 acres; in corn, 26,871 acres; in wheat, 5,549 acres; in oats, 5,438 acres; in rye, 23 acres.

Cotton production: 12,677 bales; average cotton product per acre, 0.29 bale, 417 pounds of seed-cotton, or 139 pounds cotton lint.

The chief topographical feature of Harris county is Pine mountain, a low though prominent range passing through the central part of the county into Alabama. Oak mountain enters on the east, and south of Pine mountain, with which it lies nearly parallel, to Hamilton, its terminal being on the eastern edge of the town.

Pine mountain, the higher of the two, has an elevation of 375 feet above the level of the country. Both have narrow summits, on which sandstone, dipping in opposite (anticlinal) directions, is found outcropping. Between the two mountains there is a fine valley, several miles wide, of red and gray lands, very productive, and mostly under cultivation.

The country northwest of the mountains is rolling, with lands mostly gray and sandy, but eastward they are more level. On the south the surface of the country is very similar, except from Hamilton westward to the river, which is very hilly and broken. For some miles south of the mountain the lands are gravelly and sandy, with a prominent growth of long-leaf pine in some sections.

On the south and southeast of Hamilton the lands are interspersed with red clays and are of a better class. A small outcrop of soapstone occurs at Kingsboro', with some hornblendic gneisses. The growth here is oak, hickory, pine, and a few cucumber trees.

The rocks of the county are chiefly gray gneisses with biotite mica and mica-schists. Loose fragments of quartz are very abundant on the surface in some sections.

Seven per cent. of the county area is said to be too hilly for successful tillage, and 75 per cent. has been cleared of its original growth. The streams have narrow bottoms of a rich, dark, loamy soil, but are not devoted to cotton culture.

Tilled lands comprise 30.6 per cent. of the county area, and of these 47 per cent. is in cotton, the chief crop, its average being 91.9 acres per square mile. The county ranks tenth in the state in total cotton acreage.

ABSTRACT FROM THE REPORT OF JAMES M. MOBLEY, OF HAMILTON.

The lands of the county are very much mixed, gray sandy, red sandy, and red clays occurring often within the same field.

The *sandy soils* are best for cotton, the dark clay lands being best adapted to wheat. The subsoil is generally a fine red or yellow clay. The crops of the county are cotton, corn, wheat, potatoes, rye, and sugar-cane. Cotton grows to a height of 2½ or 3 feet, and is inclined to run to weed in rainy seasons and on red or dark clay lands. A little less plowing and more guano will check this tendency and favor bolling. The yield is 800 pounds of seed-cotton per acre on fresh and 400 pounds on old land, 1,485 pounds on the last making 475 pounds of lint, the staple becoming inferior. The most troublesome weeds are hog- and coffee-weed, bull-nettle, Jamestown weeds, and May-pop vines. The uplands wash readily, doing serious damage unless checked, which is usually accomplished by ditching. One-third of the lands now lies out. When again taken in they produce very well for a few years, and cotton especially does well when the lands are level and without gullies. The climate is mild and healthy and well adapted to cotton culture, early frosts in the fall alone being injurious. The frosts of April and May seldom do much damage. One-third of the lands under cultivation is devoted to cotton.

Shipments are made to Columbus.

MUSCOGEE.

Population: 19,322.—White, 8,995; colored, 10,327.

Area: 210 square miles.—Woodland, all; sand hills, 123 square miles; metamorphic, 87 square miles.

Tilled lands: 44,718 acres, or 33.3 per cent. of county area.—Area planted in cotton, 11,625 acres; in corn, 8,263 acres; in wheat, 310 acres; in oats, 2,071 acres; in rye, 31 acres.

Cotton production: 3,268 bales; average cotton product per acre, 0.28 bale, 402 pounds seed-cotton, or 134 pounds cotton lint.

Muscogee county overlaps the granitic and metamorphic region on the north and the sandy long-leaf pine hills on the south, the Southwestern railroad almost marking the line of separation between them, while along the river is a broad and level valley extending nearly to Upatoi creek.

A small proportion of the area of the county is too hilly for cultivation. The bottom lands are about 25 feet above the river, and are not subject to overflow. Columbus is situated in this level valley, and at the foot of what here is a metamorphic terrace, which for some distance up the river is quite level, its dark, rich sandy loam soil being underlaid at a few feet by a layer of large water-worn pebbles and agates, in some places 4 feet thick, which become smaller eastward, and disappear within a few miles of the river. Underlying these uplands, and forming the high and long falls across the river, are metamorphic rocks, which differ in character from the more common varieties in other parts of the state.

Granites outcrop over most of the metamorphic section of this county, forming generally a broken country, and by disintegration a sandy and gravelly soil, with the usual red lands. The feldspar in the rock is frequently of the pink variety and large. The rocks that form the falls and the immense shoals from Columbus northward are highly siliceous, and contain biotite and some coarse, pink feldspar, which is also found below the falls. This feldspar by its decomposition probably gives to the thick beds of clays below the falls their pinkish and variegated colors. This metamorphic outcrop forms the limit of river navigation from the southward.

The pine hills of the country south of the metamorphic are high and level, having an altitude of about 200 feet above the creeks. They are covered with a growth of long-leaf pine, black-jack, with some oak. The soil is sandy and often deep, and fragments of ferruginous sandstone lie in abundance on their summits. These lands extend northward for some distance between the creeks in the metamorphic section, and yield an average of only from 5 to 7 bushels of corn or 300 pounds of seed-cotton per acre. The clays that underlie these hills are exposed along the river bluff, and near Upatoi creek are overlaid by the peculiar sand, mica, and kaolin conglomerate found in Taylor county near Geneva. Blue clay marls, having but a small proportion of carbonate of lime but some large fossil shells, outcrop in the banks of Upatoi creek for several miles, and for a very short distance north on the river bluff.

The river valley lands are somewhat open, with very small tracts of prairie. In the metamorphic the red lands, while most durable, are best for small grain, the gray sandy soils being preferred for cotton. They yield 12 or 15 bushels of corn and from 7 to 10 of wheat per acre, cotton varying from 500 to 800 pounds on the red to 800 or 1,000 on the gray land.

One-third of the county area is under tillage in cotton, corn, small grain, potatoes, etc. Cotton is the chief crop, though it comprises but 26 per cent. of the tilled lands, its average being 55.4 acres per square mile. The product per acre is low.

There are at Columbus and above on the river many large cotton factories, which consume a great part of the cotton of this part of the state as well as of the adjoining portion of Alabama.

ABSTRACT FROM THE REPORT OF JAMES C. COOK, OF COLUMBUS.

The land of the county comprises three kinds, viz: River and creek bottoms, upland red and gray oak and hickory lands, and long-leaf pine lands. The lowlands are preferred for cotton when the seasons are not wet, but the uplands are chiefly planted, as they are well drained, and on them cotton matures earlier.

The *uplands of the metamorphic section* north of Columbus have mostly a gray sandy soil, though these are interspersed with red clays, and usually have a red-clay subsoil. They cover about one-half of the county, and have a growth of oak, hickory, dogwood

and ash, interspersed with pine. The soil varies from fine to coarse sandy and gravelly, and has a depth of from 2 to 4 inches, and a heavier subsoil, which, when plowed up, becomes like the surface soil, and is best adapted to cotton, oats, and pease. Cotton comprises one-half the crops, grows to a height of 4 feet, and produces from 600 to 1,000 pounds of seed-cotton when fresh and 300 to 600 pounds after years of cultivation. From 1,350 to 1,660 pounds will usually make 475 pounds of lint. This, as well as the sandy hills soil of the southern section, washes readily, and would do serious damage but for hillside ditching. One-fourth of this land now lies out, improving very sensibly by rest.

The *dark sandy loam and clay lands*, comprising about one-fourth of the county, include the bottom and valley lands. The soil is a fine sandy clay loam from 5 to 12 inches in depth, with a heavier subsoil, which becomes like the soil by cultivation. It is early when well drained and generally easy to cultivate. The clayey areas are hard to break when dry. Cotton, comprising one-half the crops, grows to a height of from 4 to 6 feet, and is most productive at this height, yielding from 1,000 to 1,500 pounds of seed-cotton when fresh. A few years' cultivation reduces this 600 or 1,000 pounds. Cockleburs and morning-glory vines are most troublesome. One-tenth of this land now lies out, producing well when again taken in.

The *southern sandy long-leaf pine region*, covering one-fourth of the county, has a gray sandy soil from 12 to 24 inches in depth, a sandy subsoil of a yellow or red color, and a growth of pine and black-jack. Sand or gravel underlies this in places. The soil is early when well drained, otherwise late; easy to cultivate, and best adapted to cotton and potatoes. Cotton comprises two-thirds of the crops, and grows to a height of from 3 to 4 feet, but runs to weed in wet weather unless topped, and yields from 600 to 800 pounds of seed-cotton per acre when the land is fresh. After a few years this yield is only from 200 to 300 pounds. One-fourth of this soil now lies turned out, and it is improved by rest.

A number of large cotton factories are located along the Chattahoochee river.

Shipments of cotton are made to Savannah by railroad.

CENTRAL COTTON BELT.

The central cotton belt includes, in whole or in part, the counties of Columbia,* Richmond, Burke, Screven,* Jefferson, Glascock, McDuffie,* Warren,* Hancock,* Washington, Johnson,* Laurens, Wilkinson, Baldwin,* Bibb,* Twiggs, Pulaski, Houston, Crawford,* Taylor, Talbot,* Marion, Muscogee,* Chattahoochee, Stewart, Webster, Schley, Macon, Dooly,* Sumter, Lee, Terrell, Randolph, Quitman, Clay, Calhoun, Dougherty, Baker,* and Early.

COLUMBIA.

(See "Metamorphic or middle Georgia region".)

RICHMOND.

Population: 34,665.—White, 17,185; colored, 17,480.

Area: 320 square miles.—Woodland, all; oak, hickory, and pine uplands, 30 square miles; sand hills, 290 square miles.

Tilled lands: 36,626 acres.—Area planted in cotton, 7,871 acres; in corn, 11,793 acres; in wheat, 1,549 acres; in oats, 4,209 acres; in rye, 12 acres.

Cotton production: 2,742 bales; average cotton product per acre, 0.35 bale, 495 pounds seed-cotton, or 165 pounds cotton lint.

Richmond county is situated on the line between the metamorphic and pine-hills regions, and its area is divided between these, though by far the largest part is covered by the sands of the latter. The shoals in the Savannah river 3 miles north of Augusta, formed by metamorphic rocks, mark the head of navigation on that river. A canal 150 feet wide, 11 feet deep, and 9 miles in length has been constructed from the city northward, by which small boats bearing cotton and other products are enabled to reach the market from the up counties.

In the beds of the streams north of Augusta the rocks of the metamorphic are exposed, and are covered on the uplands by the sands and other material of the pine hills. Still northward are high and broken hills with red clay soils and a growth of oaks and short-leaf pine. The lands are rocky, and are known as "the Red Hills". South from Augusta the sandy pine lands are more level until the red hills of the central cotton belt are reached. Over the western part of the county, southward from a mile or two north of the railroad, are the pine hills, with their sandy soils and white clay subsoils and growth of long- and short-leaf pine and stunted black-jack oak. Ferruginous sandstone is found on these hills.

From Augusta west to Belair the county rises to 205 feet above the river, or 177 feet above the city. Berzelia, 11 miles westward on the county-line, is 193 feet higher than Belair, and is located on a ridge which on the south forms the divide between the tributaries of the Savannah river and Brier creek.

A small area covered by the red hills of the central cotton region is found in the extreme southern section of the county. They rise 135 feet above McBean's creek, and pass southward into Burke county. The extensive valley lands of the river south from Augusta are largely under cultivation in cotton. But a small percentage (17.9) of the county area is under tillage, and of these lands 21.5 per cent. is in cotton. Corn, however, is the chief crop. Cotton has an average of 24.6 acres per square mile; but 5 per cent. of the county area is said to be irreclaimable swamp. There are in Augusta four large cotton factories, two fertilizer manufactories, one cottonseed-oil mill, besides mills of other kinds. Much of the cotton of the surrounding counties is used here.

ABSTRACTS FROM THE REPORTS OF W. B. AND J. B. JONES, OF HERNDON.

The lands of the county may be placed in three classes, viz: (1) Gray, light, and sandy soils, with clay subsoils; (2) reddish or brown soils, resembling the clay subsoils on which they rest; (3) a dark gray, sometimes nearly black, found in hummocks and flat bay lands bordering the rivers, creeks, and branches. The subsoil is a sand or white pipe-clay. Cotton cannot be safely grown on these hummocks and flat lands for more than three or four years after they are first brought into cultivation, as they are then liable to rust.

The *gray sandy lands*, with red or yellow subsoils, cover two-thirds or more of the county, and have a growth of oak, hickory, and pine. The soils are from 3 to 9 inches deep, sometimes contain black gravel, and are underlaid by shell-rock at from 1 foot to 5 feet. The crops of the county are cotton, corn, oats, wheat, rye, potatoes, pease, sugar-cane, rice, and varieties of millet. Cotton comprises one-half or more of the crops, grows from 2 to 4 feet high, and runs to weed with too much rain, or when there is a deficiency of potash in the soil. On fresh lands the yield is from 800 to 1,200 pounds of seed-cotton per acre, the lint rating as middling. Cultivation of eight years reduces the yield to 600 pounds, and 1,545 pounds make 475 pounds of lint, which is shorter and inferior in every respect to that of fresh land, and rates as ordinary. Crab- and crowfoot grasses and hog-weeds are most troublesome. About two-fifths of these lands now lie turned out, but when reclaimed they yield about two-thirds of the original crop. They wash readily, and sometimes do serious damage to the slopes; but slight injury is done the valleys, which horizontalizing and hillside ditching are quite successful in checking.

The *red clay lands* of the upper part of the county comprise one-third of the entire area. The soil is usually sandy for 3 inches, but the subsoil is a tough, tenacious, and impervious clay, overlying limestone at from 1 foot to 40 feet. The land is best adapted to cotton, corn, and wheat. Two-thirds of the land under cultivation is devoted to cotton, which grows to a height of from 3 to 5 feet. From 1,000 to 1,400 pounds of seed-cotton are produced on this soil when fresh, but after seven years' cultivation it yields only 800 pounds, 1,544 pounds from old land making 475 pounds of lint. In the latter case the fiber is shorter and lighter in color. Hog-weeds are most troublesome. One-third of this land now lies turned out; when taken into cultivation again, after ten or twelve years' rest, it produces from one-half to three-fourths as well as when fresh. It washes readily and rapidly on slopes, doing serious damage also to the valleys; but little or no effort has been made to check it.

Hummock lands.—These comprise about one-tenth of the lands of the county bordering the streams, the sandy subsoil being underlaid by a tough pipe-clay and sand and gravel at from 5 to 10 feet. These lands are best adapted to corn and oats, and very little cotton is planted on them. For the first year or two cotton does well, growing to a height of from 3 to 5 feet, and yielding about 1,000 pounds of seed-cotton per acre; but after three years this yield is only from 300 to 500 pounds. Over half of these cultivated lands now lies out, and when taken in again only produce half as well as at first. The seasons in this county are not extreme as to drought and rain. The atmosphere is humid, and the nights in the latter part of summer are attended with heavy dews, which favor cotton and all fall crops, compensating in a measure for occasional droughts. The growing season is long, extending from March 15 to October 15.

Cotton is shipped from September to March, by railroad, to Savannah (mostly) at 35 cents per 100 pounds.

SCREVEN.

(See "Lime-sink and wire-grass region".)

JEFFERSON.

Population: 15,671.—White, 5,581; colored, 10,090.

Area: 620 square miles.—Woodland, all; oak, hickory, and pine uplands, 328 square miles; pine barrens (wire-grass), 141 square miles; sand hills, 151 square miles.

Tilled lands: 123,924 acres.—Area planted in cotton, 41,367 acres; in corn, 42,335 acres; in wheat, 5,783 acres; in oats, 6,146 acres; in rye, 307 acres.

Cotton production: 13,377 bales; average cotton product per acre, 0.32 bale, 462 pounds seed-cotton, or 154 pounds cotton lint.

Four divisions of lands, as in Burke, are represented in Jefferson county. Pine and sand hills lie north of Brushy creek, yellow loam with red lands southward across the creek from Louisville, and long-leaf pine and wire-grass over the southern portion of the county.

Ogeechee river flows southeast through the county, Williamson's Swamp and Rocky creeks uniting with it on the south. Brier creek forms a part of the northern boundary. The surface of the country is rolling on the west and north, but on the east there are very level oak, hickory, and pine lands, forming the greater part of the lands of the county.

The pine and sandy hills extend to within 11 miles of Louisville on the north, and resemble the same belt in Glascock county. The underlying limestone and marl outcrop in a number of points, and on the river south of Louisville the exposure in the bluffs is 15 feet thick and extends for several miles, fossiliferous sandstone overlying it in places. Silicious shell-rock is found north of Louisville in abundance, and also at the head of Spring creek, 9 miles southeast, where a quarry was at one time established.

Red lands occur on some of the hills in the county north and east of Louisville, the belt crossing in an easterly course. (See analysis, page 40.) In the northwestern corner, at Fenn's bridge, these clays have a thickness of 15 to 25 feet, and contain fossil shells (*Ostrea*).

The pine and wire-grass lands cover but a small area in the southern part of the county. Their upper limit is found 1 mile south of Williamson's swamp, near Bartow station. The country is very open and level, pine being almost the exclusive timber.

Lands under cultivation comprise 31.2 per cent. of the county area, and are chiefly devoted to corn. Six per cent. of the area is said to be too swampy for tillage. Cotton has an average of 66.7 acres per square mile, and embraces 33.4 per cent. of tilled land.

ABSTRACT FROM THE REPORT OF A. E. TARVER, OF BARTOW.

The *red and gray lands* of the county have a growth of pine, oak, and hickory. The crops are cotton, corn, wheat, rye, oats, pease, potatoes, and sugar-cane, and all do well when well manured and worked. Cotton grows 3 feet high, but runs to weed on fresh land without manure, a good fertilizer being all that is needed to restrain it. From 500 to 1,000 pounds of seed-cotton per acre are obtained from fresh

lands, 1,545 pounds being needed for 475 pounds of lint. After five years' cultivation the yield is reduced to 300 pounds of seed-cotton, 1,575 pounds being necessary for 475 pounds of lint. The staple from fresh land is good and long; that from old is short. No weeds trouble much, but grass is troublesome. About one-tenth of the lands lies turned out, and when again taken into cultivation they yield well for four or five years. They wash readily on slopes, doing serious damage, the valleys also being injured 10 per cent. Some little effort has been made to check this damage by horizontalizing, hillside ditching, and underdraining, and with pretty good success.

Shipments of cotton are made to Savannah at 40 cents per 100 pounds.

GLASCOCK.

Population: 3,577.—White, 2,506; colored, 1,071.

Area: 100 square miles.—Woodland, all; sand hills, nearly all.

Tilled lands: 25,124 acres.—Area planted in cotton, 8,175 acres; in corn, 10,742 acres; in wheat, 4,257 acres; in oats, 1,076 acres; in rye, 54 acres.

Cotton production: 2,635 bales; average cotton product per acre, 0.32 bale, 459 pounds seed-cotton, or 153 pounds cotton lint.

The small county of Glascock is almost entirely within the pine-hills region. The surface of the county is generally hilly, with mostly a poor sandy upland soil.

There is a little red oak and hickory land, with also some river and creek bottoms, which are rich and productive; but some of the latter are irreclaimable, owing to their liability to overflow.

A number of large ponds in the county, having a growth of oak, hickory, and ash, were reclaimed before the late civil war, and now produce well.

Granite is found at Ogeechee shoals and near the county-line north of Gibson, but southward in the river are the clay slates with quartz veins that occur so frequently along the lower limit of the metamorphic. They are, however, here covered on the uplands by sands of the pine hills. Two miles east of Gibson there is quite an area covered with siliceous claystones, highly fossiliferous, but the lands are sandy.

The county is drained almost entirely into the Ogeechee river, the western boundary.

Lands under tillage embrace 39.3 per cent. of the county area, and are chiefly in corn. The acreage of cotton is 32.5 per cent. of the tilled land, and averages 81.8 acres per square mile.

ABSTRACT FROM THE REPORT OF JAMES L. NEAL, OF WARRENTON.

Every kind of soil except the low, wet bottoms is devoted to cotton, but the *stiff clay lands* are considered best. These latter comprise but 10 per cent. of the lands of the county.

The growth of the county is principally long-leaf pine, but is moderately interspersed with oak, hickory, etc. The soil is a sand, 3 inches deep; the subsoil is generally a yellow or variegated-colored sand, the best varieties having a red or yellow clay. The crops are cotton, corn, wheat, and oats. The lands are best adapted to pease, though cotton comprises one-half of the crops. The plant grows to a height of from 1 foot to 3 feet, but the best yield is obtained from a height of from 15 to 20 inches. The height depends on shallow or deep tillage, the former producing fruit and little weed (small growth), the latter but little fruit and tall weed. Running to weed is prevented by early and careful topping, preceded by very shallow culture. The yield is 500 pounds of seed-cotton per acre when fresh, and from 300 to 400 pounds after five years' cultivation, unmanured. Ten years' cultivation still further reduces this product to 100 or 200 pounds per acre. From fresh land 1,845 pounds of seed-cotton make 475 pounds of lint; but 1,600 pounds are required from old land, and the staple is inferior. Crab-grass only is troublesome.

About 25 per cent. of the originally cultivated lands now lie out. Five per cent. annually is turned out, but is replaced by freshly cleared land. If allowed to rest twenty or thirty years, and then taken in, the yield for five years is better than when fresh.

Much damage is done by washing, and valleys also are injured to the extent of from 5 to 10 per cent. annually. Some little effort has been made to check it by hillside ditching, with good success if attended to after all the heavy rains.

Shipments of cotton are made to Warrenton and Augusta.

McDUFFIE.

(See "Metamorphic or middle Georgia region".)

WARREN.

(See "Metamorphic or middle Georgia region".)

HANCOCK.

(See "Metamorphic or middle Georgia region".)

WASHINGTON.

Population: 21,964.—White, 9,449; colored, 12,515.

Area: 680 square miles.—Woodland, all; sand hills, 127 square miles; oak, hickory, and pine uplands, 521 square miles; pine barrens (wire-grass), 32 square miles.

Tilled lands: 152,887 acres.—Area planted in cotton, 66,900 acres; in corn, 58,653 acres; in wheat, 7,464 acres; in oats, 7,566 acres; in rye, 1,966 acres.

Cotton production: 23,058 bales; average cotton product per acre, 0.34 bale, 492 pounds seed-cotton, or 164 pounds cotton lint.

Washington county between the Ogeechee and Oconee rivers has within its area the lands of four of the general divisions or regions, viz: the sandy pine hills on the north, red lands and yellow-loam lands in the center, and long-leaf pine and wire-grass lands on the extreme south.

The entire surface of the county is hilly and rolling, with broad and level areas, especially on the south. The sandy pine lands of the north have deep sandy soils, and the subsoils are underlaid by pipe-clay of variegated colors. They are timbered with pine (both long- and short-leaf) and black-jack oak.

Gneisses and granitic rocks appear in the beds of some of the streams, as at Long's bridge, on Buffalo creek (on the county-line), but on the immediate uplands are the sands and clays. Clay-slate is exposed in the bed of Tigor creek, 2 miles southwest of Long's bridge. This sandy pine-hills region lies north of a line from Warthen's store to Long's bridge, and thence southwest to the mouth of Gum creek.

The yellow-loam lands extend from these pine hills to the Johnson county-line, on the southwest, and 5 miles south of Sun Hill, on Williamson's Swamp creek. The lands north of Tennille are rolling and sandy, with clay subsoils, and have a growth of oak, hickory, and pine. South from Tennille they are more level, and long-leaf pine is more prominent.

Beds of white marl and limestone, with very many clypeasters and other fossils, underlie the entire region, being exposed at a number of points. Analyses of this marl made by the state geological survey show it to contain of carbonate of lime, 89.08 per cent.; phosphoric acid, 0.78 per cent; sand, 5.32 per cent. The sample was taken from a large outcrop near Tennille, in which are many fossil bones.

North of Sandersville at several points are other beds of a soft white marl differing in character from this but having a high percentage of lime, and well adapted for fertilizing purposes. Siliceous rocks containing much opal (both common and fine varieties) occur seven miles north of Sandersville in the red clay lands and in other localities in the county.

Red lands of the Red Hills belt cover large areas in this yellow-loam region, and perhaps are most prominent along Buffalo and Keg creeks and the Oconee river on the west. The surface of the country is there rolling, with high hills rising abruptly from the edge of the swamps 150 or 200 feet and heavily timbered on the slopes. The red clays capping the hills are 10 or 15 feet deep, and frequently contain silicified shells. Away from the bluffs the lands are more level and sandy. These clay lands predominate around Sandersville and for 3 miles southwest, and have a growth of post and white oaks and hickory.

The wire-grass section comprises but a small and open area on the southeast, the growth being almost exclusively long-leaf pine and wire-grass, with some black-jack. The soil and subsoil are sandy, and not very productive.

Of the area of the county, 3½ per cent. is said to be irreclaimable swamp. A little more than 35 per cent. of the county area is under tillage, chiefly in cotton and corn. The former is the chief crop, and has an average of 98.4 acres per square mile, embracing 43.8 per cent. of the tilled lands. Burke is the only county in the state having a greater total number of bales, but in its average acres per square mile Washington is surpassed by twenty-one counties, and in bales per square mile by ten counties.

ABSTRACT FROM THE REPORT OF H. N. HOLLIFIELD, OF SANDERSVILLE.

The lands of the northern and western parts of the county are stiff red clays, while on the south and east they are thin and sandy. The uplands are preferred for cotton, as it matures earlier and is not injured by the early frosts.

The *stiff red clay lands*, comprising 30 per cent. of the area of the county, are the best for cotton. They are found all over the western, middle, and upper parts of the county, and have a growth of long-leaf pine, oak, and hickory, a depth of 18 inches, and are underlaid by a deeper red clay. These lands are impervious to water unless well plowed, are too hard to plow in dry seasons, though early, warm, and well drained, and are best adapted to cotton. Cotton comprises 60 per cent. of the crops, and grows from 2 to 6 feet high, but is most productive at 3 or 4, and runs to weed when the ground is very rich and highly stimulated unless restrained by topping. Fresh lands yield 700 pounds of seed-cotton per acre the first year and 500 to 600 pounds the second; 1,485 pounds make 475 pounds of lint the second year, which rates as middling. May-pop vines, Bermuda grass, and hog-weeds are most troublesome. None of the land lies turned out, and with a little care it is always productive. The lands wash readily on slopes, but no very serious damage is done.

The *brown light clays* or chocolate loams comprise 25 per cent. of the county area, and have a growth in which long-leaf pine predominates. The soil is 6 inches deep, and the subsoil is an impervious clay, heavy and putty-like. The soil is easily tilled in all seasons, is early, warm, well drained, and is best adapted to corn and wheat. Cotton comprises two-thirds of the crop, the plant growing from 18 to 36 inches high, and yielding from 400 to 500 pounds of seed-cotton per acre on fresh land and at three years' cultivation. After three years the yield decreases. Hog-weeds and nettles are most troublesome. One-third of the land now lies out, but after ten or twelve years' rest it yields very well. The lands wash readily, and are sometimes seriously damaged. The valleys also suffer injury. The various methods of horizontalizing, hillside ditching, and underdraining are tried with success in checking the damage.

The *light sandy and gravelly land* of the lowlands comprises about 20 per cent. of the area of the county. It has a growth of pine, black-jack, gum, and sassafras. Its color varies from brown to black, and its depth is from 4 to 12 inches. Its subsoil is either a yellow clay or a fine sand, containing hard gravel and pebbles. The soil is late, cold, and ill drained, easy to till, and best adapted to grain, although cotton comprises one-third of the crops. Cotton grows to a height of from 6 to 18 inches, yielding from 300 to 400 pounds of seed-cotton, but after five years almost nothing, or 200 pounds at most. One-half of this land now lies out, and with manure will produce tolerably well. It washes readily, but no damage is done.

Cotton is shipped, as soon as ginned, to Savannah by railroad at 50 cents per 100 pounds.

JOHNSON.

(See "Pine barrens and wire-grass region".)

LAURENS.

Population: 10,053.—White, 5,702; colored, 4,351.

Area: 740 square miles.—Woodland, all; oak, hickory, and pine uplands, 259 square miles; lime-sink (wire-grass) region, 74 square miles; pine barrens (wire-grass), 407 square miles.

Tilled lands: 89,834 acres.—Area planted in cotton, 20,689 acres; in corn, 25,563 acres; in wheat, 478 acres; in oats, 4,745 acres; in rye, 498 acres.

Cotton production: 6,863 bales; average cotton product per acre, 0.33 bale, 474 pounds seed-cotton, or 158 pounds cotton lint.

The county of Laurens is divided by the Oconee river, to which nearly all the streams in the county are tributary. The surface of the country is undulating, the northern portion being covered with the lands and growth of the oak, hickory, and pine region, and the southern by wire-grass and long-leaf pine, occupying the largest part of the county.

The oak, hickory, and pine region has its lower limit one mile north of Dublin. The sandy soil and yellow sandy clay subsoil are underlaid in places by a whitish joint-clay having leaf impressions and seams of lignite. The growth of this section is pine, oak, and hickory. Red clay lands are found in some parts of the region. Some siliceous shell-rock is found on Turkey creek, on the northwest, and white limestone underlies the entire region.

The wire-grass and open long-leaf pine region comprises in this county both of its subdivisions. A narrow belt of the lime-sink (represented here by its accompanying siliceous shell-rock) occupies a narrow belt on its northern border, in which Dublin is situated. On the river at this place masses of buhr-stone are underlaid by a stiff brownish variegated clay.

The surface of the country is slightly rolling. South of this belt the region is underlaid by an argillaceous sandstone, inclosing ferruginous spots. The country is but slightly rolling or undulating and very open. The soil is dark sandy; the subsoil a yellow sand.

Two and a half per cent. of the county surface is said to be too swampy for tillage. But 19 per cent. of the county area is under cultivation, though probably 25 per cent. has been cleared. Corn has the greatest acreage; that of cotton is next, and averages 28 acres per square mile, or 23 per cent. of tilled land. Its average product per acre is above that of the region. Cotton is chiefly raised in the northern and middle portions of the county. Lumbering is a prominent pursuit of the southern part, the river affording a means of transportation in rafts to the coast.

ABSTRACT FROM THE REPORT OF ROBERT WAYNE, OF DUBLIN.

The lands of the county vary greatly. The northwest is rolling, with forests of oak and hickory, and is well watered by large creeks, and the south and southeast is level, with a fine growth of yellow pine. There is also a large extent of swamp lands in the county.

The *light gray soils*, with clay subsoils (yellow loam), are the chief cotton lands, and comprise a large part of the county area. The growth is oak and hickory. The soil is 6 inches deep; the subsoil bakes after hard rains, and requires a harrow to pulverize the soils for thorough cultivation. The lands are easy to till at all times, and are best adapted to cotton, which comprises one-half of the crops. The yield on fresh land is from 450 to 800 pounds of seed-cotton per acre; after twenty years' cultivation it is from 200 to 300 pounds. From 1,425 to 1,545 pounds of the former make 475 pounds of lint. The seeds of the first picking are heavier, and a greater weight is required for a bale than later in the season. The later the cotton the better is the yield of lint. The staple rates as middling. From 1,545 to 1,665 pounds are required for 475 pounds of lint when the lands are old, and the staple is shorter. Cotton grows 4 feet high, and is troubled most with crab-grass and crowfoot grass. About one-tenth of these lands lies turned out, and yield very well when again taken in. They wash only in places, and but little damage is done.

ABSTRACT FROM THE REPORT OF J. T. CHAPPELL, M. D., OF LAURENS HILL.

The lands are of three classes: (1) red clays on the hillsides bordering creeks and rivers; (2) gray sandy lands bordering small branches and creeks; (3) high uplands.

The *red clays* comprise one-eighth of the lands, and have a growth of oak and hickory. It is a noteworthy fact that on the southwest sides of the streams the land is red and hilly, and on the opposite less broken and sandy for from one-half to one mile. The surface soil is a brownish, sandy, gritty loam, 6 inches in depth, with a heavier subsoil of a lighter red color, underlaid at 1 foot or 2 feet by a fine red clay. The crops of the county are cotton, corn, and oats. These red lands are early, warm, well drained, and easily tilled in all seasons, and are best adapted to cotton and oats. Cotton comprises one-half of the crops, and yields 1,000 pounds in the seed on fresh land and from 500 to 750 pounds after eight years' cultivation. The staple from old land is shorter and more brittle than from fresh, but this is obviated by manuring the lands. Cotton grows to a height of from 4 to 6 feet, produces and matures best at 3 feet, and runs to weed when crowded and in wet seasons, the remedy being to give good distances and use ammoniated phosphates. Cockleburs and hog-weeds are most troublesome. One-fourth of the land lies turned out; but if allowed to rest twenty years its product for two years after being taken in again is about 75 per cent. of that of the virgin soil. Very little of it washes, and no damage is done.

The *gray land*, with its light-yellow clay subsoil and growth of pine, some oak, and dogwood, comprises about one-fourth of the lands. The soil is coarse, sandy, and gravelly in character, 4 inches deep, underlaid by clay at 2 feet, and is best adapted to corn and oats. Cotton yields on fresh lands from 400 to 500 pounds per acre in the seed, or from 300 to 400 pounds after eight years' cultivation. It grows to a height of from 2 to 3 feet. The land washes readily and covers the bottoms with sand at the end of each gully. No efforts are made to check the damage.

The *gravelly lands* of the pine woods cover five-eighths of the county, and extend from 10 to 15 miles southward. The soil is 3 inches deep, and contains black gravel; the subsoil is somewhat heavier, clay underlying it at 1 foot. Cotton comprises one-half the crops, grows 3 feet high, and yields 500 pounds per acre on fresh land and 300 pounds after eight years' cultivation. The lands are too level to wash much. The river and creek swamps have not been put into cultivation, as cotton is there more subject to rust. Fresh lands produce more weed but less fruit (in proportion to the weed) than old land.

Cotton is hauled in wagons either to the Macon and Brunswick railroad, at Eastman and Cochran, or to the Central railroad, at Toombsboro' and Tennille, for shipment.

WILKINSON.

Population: 12,061.—White, 6,550; colored, 5,511.

Area: 440 square miles.—Woodland, all; sand hills, 101 square miles; oak, hickory, and pine uplands, 339 square miles.

Tilled lands: 101,049 acres.—Area planted in cotton, 25,423 acres; in corn, 32,394 acres; in wheat, 4,872 acres; in oats, 4,957 acres; in rye, 1,404 acres.

Cotton production: 7,966 bales; average cotton product per acre, 0.31 bale, 447 pounds seed-cotton, or 149 pounds cotton lint.

Wilkinson county is separated from Washington on the east by the Oconee river, into which all the streams of the county flow. A belt of red hills passes centrally through it, presenting a rough and broken section. The ridges between the creeks are very narrow and high, and are capped with red clays and sands. The usual features of the red hills are found here, viz: red clays 25 to 50 feet thick, and siliceous fossiliferous rocks with underlying white limestone.

The southern and eastern slopes of the hills are usually abrupt and high, with red loam and a growth of oak, hickory, etc., while the northern and western slopes are more gentle, and have a sandy pine land. The northern limit of this belt is 5 miles north of Toombsboro', thence southwest to 3 or 4 miles north of Jeffersonville, in Twiggs county. The belt is narrow, and southward to Cedar creek the country becomes more sandy and level and the red lands appear less frequently. Pine forms a more prominent growth. On the south of the creek the country is again hilly and broken, with some red loam on the hills, associated with siliceous fossils and shell-rock. Outcropping in the hills are marls and clays, the former with beds of greensand, and the whole underlaid by white limestone. Along the bank of the creek the rock is also found. The growth of the hills is oak, hickory, beach, dogwood, elm, black and sweet gum, maple, etc. On the southwest, near Cool Spring, is a small "flatwoods" area of yellow clayey soil.

In the red hills section or belt small bodies of black prairie land occur occasionally, but are hardly worthy of further mention. The county north of the red belt is level and sandy, with a pine and scrub-oak growth, and belongs to the pine-hills belt of the central region, with its underlying white pipe-clays.

The lowlands and flats along the river are extensive, and in the area include Black lake, on the northeast. The width of the swamp lands is 3 miles or more in many places.

Tilled lands embrace 35.9 per cent. of the county area, while 2.5 per cent. is of irreclaimable swamp. Corn has the largest acreage, that of cotton being next, with an average of 57.8 acres per square mile, or 25.2 per cent. of tilled lands.

ABSTRACT FROM THE REPORT OF T. N. BEALL, OF IRWINTON.

The lands of the county are *light sandy and red clayey*, slightly mixed with sand, and extend across the county from east to west. The soil has a depth of from 12 to 18 inches, with a subsoil of red clay under red soils and yellow sand under gray lands. The red clays are impervious to water. The lands are early, warm, and well drained, and easy to till in all seasons. The chief crops are cotton, corn, wheat, oats, rye, potatoes, and field-peas. Cotton comprises one-third the crops, grows from 2 to 3½ feet high, and runs to weed with too much rain, to prevent which topping and fertilizers are resorted to. The yield on fresh lands is 600 pounds of seed-cotton per acre, the lint rating as middling staple. Land ten years in cultivation yields from 300 to 400 pounds per acre, and 1,545 pounds are then required for a bale of lint, the staple of which is shorter. Crab-grass alone is troublesome. One-fourth of the lands once under cultivation now lies out, but produce very well for a few years when again taken in. The lands wash readily, doing serious damage to the uplands and slightly injuring the valleys. Hillside ditching alone is depended on to check the damage, and with but little success; consequently very little effort is made in that direction.

In October and November cotton is sold and shipped, by railroad, to Savannah at $2 per bale.

BALDWIN.

(See "Metamorphic or middle Georgia region".)

BIBB.

(See "Metamorphic or middle Georgia region".)

TWIGGS.

Population: 8,918.—White, 2,844; colored, 6,074.

Area: 330 square miles.—Woodland, nearly all; sand hills, 103 square miles; oak, hickory, and pine uplands, 227 square miles.

Tilled lands: 67,050 acres.—Area planted in cotton, 29,671 acres; in corn, 23,732 acres; in wheat, 374 acres; in oats, 1,176 acres; in rye, 502 acres.

Cotton production: 8,217 bales; average cotton product per acre, 0.28 bale, 396 pounds seed-cotton, or 132 pounds cotton lint.

The county of Twiggs embraces a somewhat rolling country, bordered on the west by the Ocmulgee river, which receives a portion of the drainage waters, those on the east flowing into the Oconee.

The sand and pine hills region on the north extends from the county-line to within 3 miles of Jeffersonville, its extensive sandy lands being diversified with red clay lands, which occupy some of the ridges. The road leading from Jeffersonville to Macon lies along one of these, and the underlying red and yellow clays often come to the surface.

The wire-grass region begins 2 miles south of Hawkinsville, its limit extending east and west from here and southward over the rest of the county. The country is very open, and the growth almost exclusively long-leaf pine and wire-grass; the soil a fine sandy loam, with a yellow clayey subsoil, underlying clays, and some limestone.

The lands of the county are all considered as tillable with the exception of 4 per cent. of irreclaimable swamp. Lands under cultivation comprise 27.8 per cent. of the county area, though 45 per cent. is thought to have been cleared of its timber growth. Cotton is the chief crop (38.3 per cent. of tilled land), and has an average of 68.2 acres per square mile.

Lumber-mills are very numerous, and it is estimated that two-thirds of the timber consists of pine of superior quality. Ocmulgee river, which flows through the county, affords a convenient means of transportation for rafts of lumber to the coast. The railroad from Hawkinsville connecting with the Macon and Brunswick railroad also furnishes easy transportation of all products to the various markets.

HOUSTON.

Population: 22,414.—White, 6,024; colored, 16,390.

Area: 560 square miles.—Woodland, all; sand hills, 94 square miles; oak, hickory, and pine uplands, 466 square miles.

Tilled lands: 169,827 acres.—Area planted in cotton, 72,611 acres; in corn, 48,785 acres; in wheat, 3,289 acres; in oats, 10,570 acres; in rye, 223 acres.

Cotton production: 19,099 bales; average cotton product per acre, 0.26 bale, 375 pounds seed-cotton, or 125 pounds cotton lint.

Houston county is bounded east by the Ocmulgee river, into which all the streams of the county flow, with the exception of Hog Crawl creek, on the extreme southwest, which is separated from the rest by the Atlantic and Gulf water-divide and empties into the Flint river.

The county is within the central cotton region, and the three divisions or belts, viz, sand and pine hills, oak, hickory, and pine lands, and red hills, are all here represented.

From Echaconnee creek (the north boundary) southward to near Sandy Run creek and Bushyville the pine-hills country is quite level and sandy (see analysis, page 42), the wells showing underlying clays for 20 feet over coarse, micaceous sands and pebbles, and finally white clays. Ferruginous sandstones and gravel and sand conglomerates are scattered over the face of the country. The growth is long-leaf pine and scrub-oak undergrowth. South of this is the oak, hickory, and pine region, with its sandy soils and yellow-clay subsoils, which extends to Big Indian creek. The surface of the country is somewhat rolling, the ridges are broad and flat or gently undulating, and the approaches to the streams are abrupt and broken. Variegated pipe-clay underlies very nearly all of these lands, and ferruginous sandstone is abundant on the surface, frequently producing red sandy lands.

On the east of this region are found white coral limestones, with associated clypeasters or "petrified Indian biscuits"; but these chiefly underlie the red hills of the southern part of the county. Siliceous shell-rock fragments are also found near by. Fort Valley, on the west, is located on the high level plateau of the water-divide. The lands in this section are interspersed with spots of red clay loams, but all are underlaid by the white or variegated pipe-clay.

The red hills comprise that part of the county lying south of Big Indian creek and across from east to west. These hills are over 200 feet above the streams, are usually broad and level, and have sandy soils in the interior and red clay loams on the borders and on the slopes. Siliceous shell-rock or buhr-stone underlies or is contained in these red clays, while still below are soft friable white limestones, or, as on the south of Perry, greensand clays and marls, and then the limestone.

The following section of Ross hill, 3 miles south of Perry, is a fair representation of the underlying strata:

Reddish loam, 15 feet.
Stiff white clay, with silicified shells, etc., 30 feet.
Greensand clay, with shell impressions, 2 feet.
White pipe-clay, with beds of clayey limestone, 40 feet.
Semi-crystalline limestone, hard and compact (Montezuma), 10 feet.
White marl or limestone, 12 feet.
Yellow joint-clay, with white spots, 50 feet.

The greensand clay of this bluff is shown by analysis to contain nearly 3 per cent. of potash. (For analysis of white marl, see page 46.) A few spots of black prairie are found on the slopes of these hills. Tilled lands embrace 47.4 per cent., or nearly half of the area of the county, though 64 per cent. is said to have been cleared, and 2 per cent. is of irreclaimable swamp. Cotton is the chief crop, and has an acreage of 129.7 acres per square mile; a number surpassed only by that of Troup and Pike, comprising 42.8 per cent. of the lands under cultivation; its acreage is above 20 per cent. of the county area. In its total acreage it is surpassed only by Burke county, and in bales by Burke and Washington. Its average product per acre is very low, there being 109 counties whose rank is above it.

The general character of soils and methods of culture are the same as in the adjoining counties of Twiggs and Macon.

Shipments of cotton are made from Perry by railroad to Fort Valley, and thence to Savannah.

CRAWFORD.

(See "Metamorphic or middle Georgia region".)

TAYLOR.

Population: 8,597.—White, 4,770; colored, 3,827.

Area: 400 square miles.—Woodland, all; sand hills, 368 square miles; oak, hickory, and pine uplands, 7 square miles; metamorphic, 25 square miles.

Tilled lands: 44,770 acres.—Area planted in cotton, 18,064 acres; in corn, 16,426 acres; in wheat, 3,079 acres; in oats, 2,108 acres; in rye, 246 acres.

Cotton production: 4,854 bales; average cotton product per acre, 0.27 bale, 384 pounds seed-cotton, or 128 pounds cotton lint.

The chief feature in the topography of Taylor county is the high ridge covered with deep white sand that lies east and west just south of the metamorphic region and between Butler and Patsaliga creek, which rises abrupt and high above the metamorphic on its northern side, but gradually falls southward to the county-line, and is covered with a growth of long-leaf pine. It is about 175 feet above the creek. North of the ridge the sands continue a few miles, but under them are found the metamorphic rocks; and before Daviston and Carsonville are reached the surface of the country is covered with the gray sandy and red-clay lands of the latter, with their oak and hickory growth. Clay-slates form a bed of from 50 to 60 feet in this part of the county, resting on biotite gneisses, as seen in the river bluffs. Serpentine is exposed in the beds of streams with an apparent thickness of several hundred feet.

Lying parallel with Flint river, in the upper part of the county, north of Carsonville, are a number of prominent and rounded clay hills, standing isolated 125 feet above the surrounding level country and covered with large rounded quartz-rocks, some a foot in diameter, and lying mostly on the river side. This metamorphic region is hilly and broken, especially on the east around Grab All and Gray's ferry.

The pine-hills region, with its deep sandy lands and growth of pine and scrubby black-jack, covers most of the county. Its surface is undulating southward from the pine ridge mentioned. Variegated clays underlie the land, and ferruginous sandstone is found in scattered fragments on the surface. The small streams have usually a low, flat sandy bottom, which is covered with a growth of bays and gallberry bushes. Along the river the banks are low as far north as the agency, and the bottoms wide and partly irreclaimable.

But 17.5 per cent. of the county area is under tillage, and that chiefly in cotton, whose acreage comprises 40.4 per cent. of the tilled land, and averages 45.2 acres per square mile.

ABSTRACT FROM THE REPORT OF JAMES A. ADAMS, OF REYNOLDS.

The chief cotton lands of the county have a *sandy loam upland soil* 5 inches deep, with clay subsoil, underlaid by a brown gravelly clay, or, in some places, a variegated pipe-clay. They extend 8 miles north and 20 miles south of Reynolds, and have a growth of yellow long-leaf pine, hickory, red oak, round-leaf black-jack, and some dogwood. The crops of the county are cotton, oats, wheat, and potatoes. Cotton comprises one-third of these, and yields 500 pounds of seed-cotton per acre on fresh land, or 250 pounds after ten years' cultivation; 1,485 pounds make 475 pounds of lint, rating as upland middling. Crab-grass, and what is known as poverty-weed, are most troublesome. These lands have so few steep slopes that they wash but little, and limited damage is done.

The *light sandy lands*, having the same growth as that mentioned, and with a yellow sandy clay subsoil, yield only 400 pounds of seed-cotton per acre when fresh and 200 pounds when old and without manure. In other respects there is no difference from the other.

On the *lowlands* cotton is subject to overflows and premature frosts.

Shipments are made by railroad to Columbus or to Macon.

TALBOT.

(See "Metamorphic or middle Georgia region".)

MARION.

Population: 8,598.—White, 4,294; colored, 4,304.

Area: 360 square miles.—Woodland, all; sand hills, 174 square miles; oak, hickory, and pine uplands, 186 square miles.

Tilled lands: 77,951 acres.—Area planted in cotton, 21,579 acres; in corn, 21,053 acres; in wheat, 3,481 acres; in oats, 1,889 acres; in rye, 1,121 acres.

Cotton production: 6,169 bales; average cotton product per acre, 0.29 bale, 408 pounds seed-cotton, or 136 pounds cotton lint.

Through the middle of Marion county there is a dividing ridge separating the tributaries of the Flint and Chattahoochee rivers. That portion of the county north of Buena Vista and Glen Alta is rolling and covered with the white sands and pine growth of the sandy pine-hills region, and is but slightly under cultivation, the lands being poor and unproductive. Blue micaceous and shell clays are found underlying these hills a short distance north of Tazewell, and also on Richland creek, north of Buena Vista. They contain scarcely any lime, and are not a profitable fertilizing element.

Ferruginous concretions inclosing sand exist in abundance on the hills. The hill on which the county-seat is located has a thick covering of ferruginous pebbles.

Between Buena Vista and Kinchafoona creek (on the west) there are deep white-sand beds, which extend southward along the creek; but on the west of the stream there are red clay lands, and these are also found over the southern part of the county.

The entire surface of the country is rolling and somewhat hilly, but has broad areas of level lands; 5 per cent. is too hilly for cultivation. In the banks of the creek at Pineville, in the southwestern corner of the county, there are beds of yellow and blue fossiliferous Cretaceous marl, containing more lime than those mentioned above.

There is 1 per cent. of irreclaimable swamp land in the county.

The lands under tillage embrace 33.8 per cent. of the county area, though 75 per cent. are said to have been cleared of their original timber growth. Of these lands, 27.7 per cent. is in cotton, one of the chief crops (corn having nearly the same acreage), its average being 59.9 acres per square mile.

ABSTRACT FROM THE REPORT OF G. W. C. MUNRO, OF BUENA VISTA.

Some of the uplands are rolling and sandy, but very productive; others are level, with a good clay subsoil, but of poorer quality. Upland cotton can be planted earlier than that on the lowlands, but without fertilizers does not grow off so rapidly as on the latter or produce as much. The proportion of lowlands is very inconsiderable when compared to the uplands; but as a general thing they are level and last well, but have to be rotated and rested in order to retain their fertility.

The soils devoted to cotton culture may be classed as clay lands, or those having a good clay subsoil; sandy lands, or those whose subsoil is loose and several feet deep; and hummock lands.

The *clay lands* are the best, and comprise about one-half of the county, covering areas sometimes 8 or 10 miles long and 2 or 3 wide. The growth is pine, with an undergrowth of black-jack, and some hickory and post oak. The soil is a clay mixed with sand and decayed vegetable matter, pale yellow and brown in places, and in others almost white, 6 inches deep, with a tolerably stiff subsoil, red in color, and containing more or less sand; a hard-pan, quite impervious in places, and should be broken with the plow or crops will suffer if the seasons are unfavorable. The lands are easily tilled in all seasons when well broken up in the spring. The crops of the county are cotton, corn, oats, wheat, rye, potatoes, sugar-cane, ground-peas, chufas, millet, and Hungarian grass, and there is seldom a failure to make a good crop when well fertilized. Cotton yields from 700 to 1,000 pounds per acre in the seed on fresh lands, the lint rating high. Ten years' cultivation reduces the yield to about 300 pounds. The quantity and the quality of the staple are affected principally by the seasons. The plant grows 2½ feet high on an average, but from 3 to 4 feet is best. It seldom runs to weed, and superphosphates favor fruiting. Crab-grass generally and hog-weeds frequently give much trouble, and on badly worn soils poverty-weed grows abundantly. About one-twentieth of the lands now lies turned out, caused by washing and gullying. When not too badly washed they yield pretty well for a few years after resting. The valleys are injured to such an extent that the small streams that flow through and drain them are filled up and have to be ditched. Horizontalizing and hillside ditching yield satisfactory results when rightly done.

The *sandy lands* of the north and east of the county cover about one-half of its area, and have a growth of pine principally and an undergrowth of black-jack. The soil is a fine or coarse sandy loam with a depth of 1 foot and a subsoil of sand, with a little clay in places and coarse sand in others. It is late and cold, easily tilled, and can be plowed in wet as well as in any season, but cannot be planted as early as the clay lands. The soil is best adapted to cotton and corn when fresh, but when old and worn cotton rusts on it badly. Cotton grows 2 feet high, and yields on fresh lands from 600 to 1,000 pounds per acre in the seed. Ten years' cultivation reduces this to 300 pounds. When the lands are fresh, rag-weeds, but when old, poverty-weeds, are the most troublesome. The lands wash readily, and serious damage is done. One-twelfth of the land now lies out.

The *hummocks* comprise only a few hundred yards in the county, and have a growth of white oak, beech, maple, walnut, hickory, ash, etc. The soil is a fine sandy loam, blackish in places, 10 inches or more in depth, with a yellow clay or coarse sandy clayish subsoil, quite leachy generally. Fine crops of sugar-cane, corn, and cotton are produced on these lands, cotton growing 4 feet high and yielding about 1,000 pounds per acre on fresh land, or 400 pounds on land ten years in cultivation if rolling and never ditched. Hog-weeds alone are troublesome.

From the 15th of September to the 25th of December cotton is shipped by wagon to Americus, Sumter county, at 50 cents per 100 pounds.

MUSCOGEE.

(See "Metamorphic or middle Georgia region".)

CHATTAHOOCHEE.

Population: 5,670.—White, 2,130; colored, 3,540.

Area: 220 square miles.—Woodland, all; sand hills, 76 square miles; oak, hickory, and pine uplands, 144 square miles.

Tilled lands: 38,457 acres.—Area planted in cotton, 15,442 acres; in corn, 11,618 acres; in wheat, 740 acres; in oats, 1,774 acres; in rye, 396 acres.

Cotton production: 4,460 bales; average cotton product per acre, 0.29 bale, 411 pounds seed-cotton, or 137 pounds cotton lint.

Chattahoochee is a rather hilly county, and is separated from Alabama by the Chattahoochee river and from Muscogee county by Upatoi creek. The greater part of the northern portion of this county is covered with white micaceous sands and ferruginous sandstones of the sand-hills region, underlaid by variegated clays. In some places on the northwest heavy beds of white water-worn pebbles and ferruginous sand and pebble conglomerates are exposed in bluffs or hillsides. In the southern part of the county the red clays approach nearer the surface, and often, by the washing away of the sands, are exposed on the hillsides and tops and are more or less intermixed with the sands. These hills are embraced in the yellow-loam region south of Glen Alta and Cusseta. They are often 100 or 150 feet above the streams, and their lands wash readily, forming great gullies.

The lands along the river on the northwest are generally quite level, but become hilly and broken northward. They are 25 feet above low water, and in their bluffs there is exposed under the sands and clays 18 feet of blue micaceous and gypseous clay, with a small percentage of lime, and containing a few Cretaceous fossils. A white sand underlies the bed. These marls outcrop along Upatoi creek for some distance, and southward along the river become more fossiliferous and valuable. An analysis of a specimen taken from near Cusseta shows only about 10 per cent. of carbonate of lime and a small amount of potash and phosphoric acid. For fertilizing uses the marl is almost worthless.

The growth of the county is largely pine on the hills, with oak, hickory, etc., on the lower and better lands. The gray oak and hickory lands are considered the best, and will yield from 10 to 15 bushels of corn, 8 to 10 bushels of wheat, or about 600 pounds of seed-cotton per acre. Their growth is red and post oaks, hickory, and poplar.

The mulatto and red lands have also a red and post-oak growth, and will yield from 8 to 10 bushels of corn or of wheat or 600 pounds of seed-cotton per acre. Lands under tillage embrace 27.3 per cent. of the county area, though it is thought that 60 per cent. has been cleared. Of these 40.2 per cent. is in cotton, the chief crop, its average being 70.2 acres per square mile.

ABSTRACT FROM THE REPORT OF J. H. WOOLDRIDGE, OF JAMESTOWN.

The uplands of the county on the river are partly black prairie and partly hog-wallow. The soils devoted to cotton are the black uplands, lying mostly on hills and branches, alluvial bottoms adjacent to branches and small streams that overflow occasionally, and light sandy bottoms on various branches of creeks and rivers.

The chief land is that of the *alluvial bottoms*, comprising one-fourth or one-fifth of the lands of the region, which are from 4 to 6 miles in extent. Its growth is pine, oak, hickory, sweet gum, chestnut, elm, dogwood, chincapin, willow, and persimmon. The soil is a fine sandy clay loam, from yellow to red in color, with a red clay or yellow sandy subsoil. The crops of the county are corn, pease, oats, wheat, rye, potatoes, pinders (ground-pease), chufas, and cotton. All do well under favorable seasons and good culture. Cotton comprises one-half of the crops, and yields from 400 to 800 pounds of seed-cotton per acre, 1,545 pounds of which make 475 pounds of lint, rating as middling. The plant grows from 1 foot to 10 feet high, running to weed by late planting and with too much rain. Morning-glory vines, cocklebur, crab-grass, and crowfoot are the most troublesome weeds. One-half the lands originally cultivated now lies turned out, and produces moderately well for a few years when again cultivated. Considerable damage is done to slopes and valleys by the ready washing of the land. Hillside ditching and horizontalizing are successful in checking the injury.

Cotton is shipped to Columbus by river boats at 50 cents per bale.

STEWART.

Population: 13,998.—White, 4,376; colored, 9,622.

Area: 440 square miles.—Woodland, all; oak, hickory, and pine uplands, 440 square miles.

Tilled lands: 107,251 acres.—Area planted in cotton, 44,449 acres; in corn, 31,979 acres; in wheat, 2,652 acres; in oats, 5,284 acres; in rye, 206 acres.

Cotton production: 12,653 bales; average cotton product per acre, 0.28 bale, 405 pounds seed-cotton, or 135 pounds cotton lint.

Stewart county, separated from Alabama by the Chattahoochee river, is included in the oak, hickory, and long-leaf pine region. Its general surface in the interior is hilly and broken, but there are broad, level valley lands along the river a mile or two wide and level uplands on the east around Richland, and also south of Lumpkin, the county-seat. The banks of the Chattahoochee river are high, and along their bluffs are exposed blue-shell marls, and also greensand marls rich in potash. The lime percentage is not great.

These Cretaceous marls are also exposed in the beds of Hitchetee, Hannahatchie, and other creeks of the county, except on the southeast, where the country is higher and of a different character.

The southeastern limit of the blue-marl region is found 5 miles north and 8 miles west of Lumpkin. At the former locality the blue marl is overlaid by yellow fossiliferous clays, the hills being capped with red clays and white sands. These hills wash readily, and immense gullies and ravines have been formed on the sides, showing heavy beds of clays variegated in color, and known as "calico clay". The same is true of the hills for 8 miles on the west of Lumpkin. They are covered in many instances with a hematite iron ore having a bright surface. Siliceous shell-rock, or buhr-stone (Tertiary), and ferruginous sandstone is also abundant in places. These hills are about 450 feet above the river, and, while very sandy, are often red, from the exposure of the red clays underlying the white sands or from the intermixture of the two. These red clays occur over the eastern side of the county and northward into Chattahoochee.

From Lumpkin southward the lands, while high, are more level and the sands not so deep. Red soils also cover large areas (see analysis, page 40), and fragments of buhr-stone are found on the surface. In these latter siliceous sponge spicules have been observed, and the rocks seem to be similar to those found in Burke county, on the east of the state.

The lands of the western part of the county are generally quite level, except along the small streams. From Florence and southward the valley extends eastward several miles, the soil being a sandy loam and the subsoil a clay. The lands are very productive and have been long in cultivation.

Of the county area 2½ per cent. is too hilly or broken for cultivation and 1 per cent. is irreclaimable swamp. Of the total area 38.1 per cent. is under tillage, chiefly in cotton and corn, the former having the largest acreage, and averaging 101 acres per square mile. The county ranks in this average as sixteenth in the state and in total acreage as eighth, in total number of bales as thirteenth, and in bales per square mile as twentieth.

ABSTRACT FROM THE REPORT OF W. H. TATUM, OF HANNAHATCHIE.

The lands of the county have an oak and pine growth, and are best adapted to cotton and cane. The crops are corn, cotton, pease, and sugar-cane. Cotton comprises two-thirds of the crops, grows from 2 to 6 feet high, runs to weed in wet summers and with excess of rain, and yields from 800 to 1,000 pounds of seed-cotton per acre, the lint rating as middling. After six years' cultivation the yield is from 500 to 800 pounds, and 1,665 pounds make 475 pounds of lint, the staple of which is not so good by 10 per cent. Hog-weeds are very troublesome. One-fourth of the lands originally cultivated now lies turned out, and when again taken in produce finely for three or four years. When not ditched the lands by washing are greatly damaged, and the valleys are also injured.

As fast as ginned cotton is shipped to Columbus at 40 cents per 100 pounds.

WEBSTER.

Population: 5,237.—White, 2,667; colored, 2,570.

Area: 230 square miles.—Woodland, all; oak, hickory, and pine uplands, all.

Tilled lands: 43,762 acres.—Area planted in cotton, 17,235 acres; in corn, 16,121 acres; in wheat, 2,236 acres; in oats, 2,809 acres; in rye, 463 acres.

Cotton production: 4,642 bales; average cotton product per acre, 0.27 bale, 384 pounds seed-cotton, or 128 pounds cotton lint.

The surface of Webster county is generally hilly and rolling, especially on the north, where the hills are covered with white sands and red clays over variegated clays and Cretaceous marls in places. Short-leaf pine forms a prominent growth.

The uplands on the west and south of Preston, the county-seat, are quite level, but the many small streams give the entire county a rolling character. Over this southern portion red-clay hills, more or less sandy, form a prominent feature, and ferruginous sandstone, often a hematite, is abundant. Siliceous shell-rock, or buhr-stone, is found in fragments over the country.

Tilled lands embrace 29.7 per cent. of the county area; irreclaimable swamp, 4 per cent. Sixty per cent. of the entire area is reported to be cleared of original timber growth. Cotton has a larger acreage than corn, comprising 39.4 per cent. of tilled land, and averaging 74.9 acres per square mile.

ABSTRACTS FROM THE REPORTS OF JAMES P. WALKER AND JUBILEE SMITH, OF PRESTON.

The lands vary materially in fertility and quality of soil. The hills are mostly coarse sand; the level lands usually have a clay subsoil from 3 to 10 inches under the surface. About three-fourths of the uplands are hilly and sandy, with sandy subsoils; the rest have a clay soil or a clay subsoil under 3 inches of sand. The natural growth of the sandy hills is pine; that of the sandy level lands black-jack and scrub pine. Those lands having a clay subsoil have a growth of pine, oak, and hickory. The clay subsoil hardens somewhat by exposure, but readily intermixes with the surface soil by cultivation, readily absorbing moisture and quite readily yielding it to the influence of the sun. The lands areunder laid by sand and rather soft lime-rock at 4 feet. Tillage is easy and pleasant in any weather, requiring but little exertion.

The chief crops are cotton, corn, wheat, oats, rye, pease, potatoes, sugar-cane, sorghum, and rice. Cotton succeeds best, though all are remunerative with proper cultivation. Cotton usually comprises about three-fourths of the crops, and yields from 600 to 800 pounds per acre in the seed on fresh land; from 1,425 to 1,545 pounds of this make 475 pounds of lint. On land four years under cultivation the yield is from 300 to 500 pounds, the lint being shorter and the fiber not so strong. The plant grows from 2½ to 6 feet high, yields best at 3 feet, and runs to weed on new ground and with continuous rains in the spring. This is prevented and bolling favored by an extensive use of home-made and commercial fertilizers. Hog- and poverty-weeds, crab- and crowfoot-grasses are most troublesome. From one-eighth to one-fourth of the land once under cultivation now lies out, and produces about three-fourths of a crop after a rest of three years. The uplands are much damaged by the washing and gullying of the lands. Before the late civil war efforts were made to check this, but very little since. When horizontalizing was properly executed the damage was successfully checked. The valleys are injured only in localities.

The swamp lands are from 200 to 600 yards wide, and run diagonally through the county. By proper drainage they could be made far more valuable than the uplands.

Cotton to succeed well on sandy land must be planted late, its cold nature in spring tending greatly to kill out the plants. The level or clay subsoil lands may be planted twenty days earlier, with a better prospect of a perfect stand and certainty of a more remunerative yield. Sandy soils usually produce more fruit than clay soils in proportion to size of weed and contingencies of seasons.

As soon as baled cotton is hauled by wagon to Americus.

SCHLEY.

Population: 5,302.—White, 2,229; colored, 3,073.

Area: 180 square miles.—Woodland, all; sand hills, 8 square miles; oak, hickory, and pine uplands, 172 square miles.

Tilled lands: 38,931 acres.—Area planted in cotton, 19,143 acres; in corn, 15,845 acres; in wheat, 1,944 acres; in oats, 1,447 acres; in rye, 444 acres.

Cotton production: 4,945 bales; average cotton product per acre, 0.26 bale, 369 pounds seed-cotton, or 123 pounds cotton lint.

The county of Schley is included almost entirely within the oak, hickory, and pine region. The northern part of the county is hilly and broken, the ridges being covered with deep white sands and red and yellow clays and a heavy growth of long-leaf pine and scrub oak. These extend to within 5 miles of Ellaville. The county then becomes level, with a dark clay loam soil and a hard red ferruginous clay subsoil. This belt, 2 miles wide, crosses the county southeastward into Sumter county. Its growth is red and post oak, short-leaf pine, and hickory. Blue Cretaceous clay marls are found at 50 and 60 feet in wells in this section, and come nearer the surface 5 miles northwest of Ellaville. The country south of Ellaville is slightly rolling, with a dark sandy loam soil and a red and yellow clay subsoil. The growth is long-leaf pine, interspersed with oak and black-jack.

Limestone and siliceous rocks or buhr-stone are found at Quebec on the southwest and under the clays of the hills.

Eastward from Ellaville, the county-seat, the country is rather broken for 7 miles, then becomes rolling, with much red land and ferruginous pebbles. In some places the beds of red sand and pebbles are several feet thick, and are underlaid by a white plastic clay. Long-leaf pine is a prominent growth, and the undergrowth is rather open. Ferruginous sandstone often occurs in fragments on the surface.

A small percentage of the lands of the county are too hilly or swampy for tillage, and 72 per cent. is said to have been cleared. Tilled lands comprise 33.8 per cent. of the county area, and are chiefly in cotton and corn, the acreage of the former being greater and comprising 49.2 per cent. of tilled land, Troup and Putnam counties alone having a greater proportion. Its average per square mile is 106.4 acres, the county thus ranking as thirteenth in the state.

ABSTRACT FROM THE REPORT OF THOMAS F. RAINEY, SR., OF ELLAVILLE.

There are but two extensive varieties of land in the county, viz, dark and red sandy loams. There is very little lowland, some of which has been cleared and produces well, but cotton is subject to rust in excessively wet seasons.

The *red sandy lands* comprise about 75 per cent. of the lands of the county, and have a growth principally of pine, with every description of oak. The soil is a sandy loam 6 inches deep, with a red or yellow sandy clay subsoil, underlaid by coarse gravel of various colors. The land is easy to till in all seasons, is early, warm, and well drained, and is best adapted to cotton, though corn, wheat, oats,

South of the area described, and extending across the county east and west, the gray sandy lands become interspersed with red hills and large areas of red clay lands. The country is high and rolling, underlaid by variegated and plastic clays, and has a growth of pine, with oak and hickory. Open pine lands occasionally occur.

On the west, at the Plains of Dura, the country is very level over a large area. Around Americus, and eastward nearly to Danville, buhr-stone or siliceous shell-rock occurs in quantities, and the fragments are frequently studded with fine quartz crystals. The sands that cover the northern portion of the county are here not so deep, and red clays prevail over this and the southwestern part. Ferruginous gravel and pebbles are abundant.

Five or more miles southeast from Americus changes again occur, and open long-leaf pine growth, wire-grass, and cypress ponds cover an area 5 miles wide, extending into Lee county on the southwest. The surface is flat, the soils sandy and poor, and but little under cultivation. Still to the southeast, and covering the rest of the county, are oak and hickory lands, quite level, underlaid by a very white and soft friable coral limestone, which frequently comes to the surface. (See analysis of soil, page 40.)

At Danville, on the river (east from Americus), there is a bed of white shell marl, with greensand beds 15 or 20 feet thick under 20 feet of red clay. It extends up the river a number of miles, but seems to become more clayey.

The limestone is the same as that at Albany, which shows about 74 per cent. of carbonate of lime. It has been used, pulverized, on a number of farms, and with marked and beneficial results, especially after the first year. The growth on streams where this limestone outcrops is poplar, magnolia, black and sweet gum, white oak, swamp dogwood, cypress, water oak, sweet bay, ironwood, wahoo, ash, sugar-maple, alder, and saw-palmetto.

Tilled lands embrace 31.4 per cent. of the county area; irreclaimable swamp lands 3 per cent; and of the entire county it is thought that 46 per cent. has been cleared. Cotton is the principal crop of the county, averaging 85 acres per square mile, and embracing 42.2 per cent. of tilled land. The county ranks as ninth, or next to Stewart, in its total cotton acreage.

ABSTRACTS FROM THE REPORTS OF S. S. BIRD, M. D., AND C. C. SHEPHARD, OF AMERICUS.

The lands of the county are about equally divided between the red mulatto and the gray soils. The growth of the gray lands is pine; of the red, pine and oak. The soils are from 5 to 10 inches deep; the subsoils usually hard and tough clays. The chief crops are corn, cotton, oats, pease, sweet and Irish potatoes, chufas, ground-pease, rye, and wheat. On good land, and with good culture, all flourish in seasonable years. On the gray lands in wet seasons cotton suffers from rust. Cotton comprises about half the crops, and on fresh lands yields from 400 to 700 or even as much as 1,000 pounds of seed-cotton per acre. On lands ten years under cultivation the yield is about one-half that of fresh lands, and over 1,600 pounds are required for 475 pounds of lint. Cotton grows from 3 to 4 feet high on red land and from 1½ to 2½ feet on gray. The plant runs to weed, when the fly stings the squares and they fall off. Crab-grass is by far the most common and most injurious weed. May-pop vines and coffee-weeds are also troublesome.

From one-tenth to one-fifth of these lands now lies turned out. If allowed to lie out long enough to produce a second growth of pines it yields, on cultivation, almost as well for a few years as when new. Washing and gullying are the most fruitful source of injury to the uplands; the valleys are generally improved by the deposit of fresh soil, and marshes and swamps are frequently so filled up with the soil from adjoining hillsides as to become the very best lands of the county. But little effort is made to check this washing.

As soon as cotton is ginned and baled it is shipped by railroad to Savannah.

LEE.

Population: 10,577.—White, 1,739; colored, 8,838.

Area: 360 square miles.—Woodland, all; lime-sink (wire-grass) region, 101 square miles; oak, hickory, and pine uplands, 259 square miles.

Tilled lands: 99,449 acres.—Area planted in cotton, 35,694 acres; in corn, 24,045 acres; in wheat, 367 acres; in oats, 6,721 acres; in rye, 149 acres.

Cotton production: 9,143 bales; average cotton product per acre, 0.26 bale, 366 pounds seed-cotton, or 122 pounds cotton lint.

The surface of Lee county is for the most part level or undulating, and is timbered with pine, oak, and hickory, with a more or less dense undergrowth. The county is mostly included in the oak, hickory, and pine region, and is drained into Flint river, its eastern boundary.

White limestone and marl (Eocene) underlies the entire county, outcropping along the streams, and often associated with siliceous shell-rock or buhr-stone, whose fragments are also found lying loose on the surface, especially on the northwest.

A cross-section of the county from northwest to the southeast would show first a rather open and level country, in which long-leaf pine predominates, with some undergrowth, and the lands sandy and interspersed with a few red areas—a continuation of the belt south of Americus, in Sumter county. Large cypress swamps and deep beds of white sands occasionally occur. The soil contains ferruginous pebble and gravel. On the south of Adams station, or 5 miles from Starksville, is a belt of open long-leaf pine and wire-grass very level, and having a width of about 2 miles, a continuation also of that of southeast Sumter. Oak and hickory lands then appear, forming a somewhat rolling northeast and southwest belt across the county, with an average width of 3 miles. (See analysis of soil, page 42.) The lands are red sandy clays several feet deep, the underlying limestone coming near the surface and by dissolution from underground streams producing many lime-sinks. When burnt it makes an excellent quality of lime. It is associated with marls, and their application to the lands has proved highly beneficial wherever tried. J. Shep. Green, on Chocky creek, in the northeastern part of the county, reports a great improvement in the soil and a better yield of seed-cotton. The marl or soft limestone contains about 80 per cent. of carbonate of lime (see analyses of similar marls, page 46). Buhr-stone and flint overlie this limestone, and their relative position is well seen at Palmyra, on the southwest. The rest of the county in the southeast of this oak and hickory belt is flat and open, with a tall growth of long-leaf pine, and is interspersed with many ponds. It has a sandy soil, clay subsoils, and limestone at 30 feet. Wire-grass covers the region, and the country is but sparsely settled. The lands of the county are almost entirely tillable, and one-half has been cleared.

The lands of the county under tillage embrace 43.2 per cent. of the area, and are largely planted in cotton, that crop having an average of 99.2 acres and 25.4 bales per square mile, its acreage being 35.9 per cent. of the tilled lands.

Shipments of cotton are made by railroad to Albany, and thence to Savannah or northward to other markets.

TERRELL.

Population: 10,451.—White, 4,268; colored, 6,183.

Area: 320 square miles.—Woodland, all; oak, hickory, and pine lands, all.

Tilled lands: 58,844 acres; area planted in cotton, 25,740 acres; in corn, 21,719 acres; in wheat, 1,928 acres; in oats, 6,210 acres; in rye, 246 acres.

Cotton production: 6,944 bales; average cotton product per acre, 0.27 bale, 384 pounds seed-cotton, or 128 pounds cotton lint.

Terrell county is included entirely in the oak, hickory, and pine region. Its surface is undulating, or rather rolling; its growth, oak, hickory, and long-leaf pine, the latter being very prominent, and in places almost exclusive, with little undergrowth, and giving to the country a very open appearance.

Soft white limestone underlies the county and outcrops in some of the streams, furnishing a valuable stimulant for these lands when properly applied. Buhr-stone or siliceous shell-rock, very flinty in character, occurs in fragments on the surface.

The lands of the county, part clayey and part sandy, are underlaid by red and yellow clays, and contain more or less ferruginous gravel.

The surface is drained southward by numerous streams, also by Kinchafoona creek, the eastern boundary to Flint river. Cypress swamps are abundant in the county.

Tilled lands embrace 28.7 per cent. of the county area, and are chiefly devoted to cotton and corn, the acreage of the former being 43.7 per cent. of the tilled lands, and averaging 80.4 acres per square mile.

Shipments of cotton are by railroad to either Columbus or Macon, though most of the crop is sold from the wagon at Dawson.

RANDOLPH.

Population: 13,341.—White, 5,545; colored, 7,796.

Area: 400 square miles.—Woodland, all; oak, hickory, and pine uplands, all.

Tilled lands: 91,249 acres; area planted in cotton, 34,204 acres; in corn, 27,484 acres; in wheat, 2,790 acres; in oats, 6,770 acres; in rye, 637 acres.

Cotton production: 8,467 bales; average cotton product per acre, 0.25 bale, 354 pounds seed-cotton, or 118 pounds cotton lint.

The surface of Randolph county is generally rolling, and is broken on the north, but more level on the south. The lands of the northern half are partly gray sandy and partly red clayey; the subsoil of each almost entirely a red or yellow clay. Some of the uplands have large level areas, and are largely under cultivation, yielding fair crops of corn and cotton.

A white fossiliferous limestone (Eocene), having occasionally calcite crystals, underlies the section, and several large caves exist on the northwest. Siliceous shell-rock and ferruginous sandstone are abundant on the surface, some of the former being quite large.

The lands near Cuthbert and southward, as well as west for some miles, are much more level. Along some of the creeks on the south there are a better class of red clay soils and subsoils, with a growth of oak, hickory, and pine; but the rest of the uplands are generally sandy, with a prominent growth of long-leaf pine, interspersed with oak and hickory. The lands contain ferruginous pebbles or gravel, and siliceous shell-rocks are found everywhere. A bed of this several feet thick, and containing quite a variety of well-preserved fossils, is found 4 miles south of Cuthbert.

Sixty per cent. of the county area is said to have been cleared of its original timber growth, but only 35.6 per cent. is under cultivation. Eight per cent. is of irreclaimable swamps. The chief crop is cotton, its average being 85.5 acres per square mile, or 37.5 per cent. of tilled lands.

ABSTRACT FROM THE REPORT OF M. A. M'NULTY, OF CUTHBERT.

The lands on the Nochway (on the southeast) are red calcareous clays, with some undulating sandy ridges; on the Pachitta (south) generally red clay, and on the Pataula sandy ridges prevail.

The *red clay lands* of the county, in some places strongly impregnated with lime, are the best cotton lands. They cover about one-half the county area, and have a growth of oak, hickory, and pine. The soil is often a gray sand, 4 inches deep; the subsoil a red clay, impervious when dry, and becoming hard when not disturbed, but good cultivation assimilates it to the surface soil. The land contains ferruginous pebbles, is easily tilled in wet seasons, is early, warm, and well drained, and well adapted, when fresh, to cotton, corn, wheat, oats, sugar-cane, and sweet and Irish potatoes. Cotton comprises one-half the crops, grows 2 feet high, and is prevented from running to weed by the use of marl, which is abundant. Fresh lands produce 800 pounds of seed-cotton per acre; the lint is a fair upland staple. Lands under cultivation five years yield 250 pounds of seed-cotton per acre, of which 1,545 pounds make 475 pounds of lint of inferior quality. Crab-grass and hog-weed are most troublesome. One-half of the lands once cultivated now lies turned out, and when these lands are again taken in they produce well for two or three years. The valleys are ruined and uplands seriously damaged by the washing and gullying of these lands, and no efforts have been made to check it.

The *sandy lands*, comprising one-third of the area, extend diagonally across the county, and have a growth of pines. The soil is of a dark gray and fine sandy character, 10 inches deep, with an impervious red clay or sandy subsoil. The lands are late, cold, well drained, and are best adapted to cotton, which comprises two-thirds of the crops. Fresh lands yield 800 pounds of seed-cotton per acre; lands cultivated five years yield only 200 pounds, and 1,665 pounds are required for 475 pounds of lint. These lands also wash as readily as the clay soils, and as much damage is done.

There is a class of putty-like land occurring in spots on worn-out hillsides that is utterly unproductive, and which ruins bottom lands by washing.

As soon as cotton is ginned and baled it is shipped by railroad to Savannah at $3 50 per bale.

QUITMAN.

Population: 4,392.—White, 1,773; colored, 2,619.
Area: 160 square miles.—Woodland, all; oak, hickory, and pine uplands, all.
Tilled lands: 25,584 acres.—Area planted in cotton, 11,815 acres; in corn, 7,596 acres; in wheat, 560 acres; in oats, 2,202 acres; in rye, 29 acres.
Cotton production: 3,163 bales; average cotton product per acre, 0.27 bale, 381 pounds seed-cotton, or 127 pounds cotton lint.

The small county of Quitman lies on the Chattahoochee river, to which all of its streams are tributary. The surface of the country is hilly and broken, and its hills are covered with red clays and white sands. The former, occurring principally in the eastern and southern part of the county, are the continuation of those of the adjoining counties of Stewart and Randolph. Along the river at a number of points are level valley lands, a mile or more wide, having a dark sandy loam soil. The bluffs of the river are from 25 to 50 feet high, and in them, under a heavy bed of clay, is exposed the blue micaceous clay marls full of very well-preserved Cretaceous fossils (Ripley group). These marls are found also in the beds of the small streams that empty into the river. The most easterly outcrop is in a railroad cut on the upland at Hatchie station. A fossiliferous limestone forms thin layers in these river bluffs.

The sandy hills cover the largest part of the county, and have a prominent growth of pine. The red lands have a timber growth of oak and hickory; the bottoms, oak, hickory, and cottonwood. Ferruginous sandstone and pebbles are abundant on many of the hills.

Sixty-four per cent. of the lands of the county are said to have been cleared, but only 25 per cent. are under tillage. Cotton, the chief crop, has an average of 73.8 acres per square mile, or 46.2 per cent. of the lands are under cultivation.

The marls of the county are not very rich. An analysis of a sample from Hatchie station shows the presence of not more than 14 per cent. of carbonate of lime, the rest being chiefly sand and clay.

ABSTRACT FROM THE REPORT OF A. OGLETREE, OF GEORGETOWN.

The lands of the county may be classed as gray, red or stiff, and alluvial.

The *coarse gray sandy soils* comprise two-thirds of the lands of the county. They are from 4 to 8 inches deep, with a subsoil of similar character, and are best adapted to cotton and oats. Cotton grows 2½ feet high, the larger the better, and yields from 500 to 600 pounds in the seed per acre on fresh lands, 1,485 pounds making 475 pounds of lint. After a few years' cultivation the yield is about 300 pounds, and the same amount is needed for a bale of lint. Weeds are not troublesome, but crab-grass is a constant trouble. Of the lands once under cultivation about 10 per cent. now lies turned out. The productiveness when again taken in depends upon the length of time it has rested; if long enough, it yields as well as new. These lands are injured by washing and gullying, and the valleys are somewhat damaged. But little effort is made to check it.

The *red and stiff lands* have also a stiff clay subsoil and a growth of oak and hickory.

From September to January cotton is shipped by railroad to Savannah.

CLAY.

Population: 6,650.—White, 2,798; colored, 3,852.
Area: 200 square miles.—Woodland, all; oak, hickory, and pine uplands, all.
Tilled lands: 53,952 acres.—Area planted in cotton, 21,539 acres; in corn, 14,898 acres; in wheat, 156 acres; in oats, 2,844 acres; in rye 29 acres.
Cotton production: 4,576 bales; average cotton product per acre, 0.21 bale, 303 pounds seed-cotton, or 101 pounds cotton lint.

The small county of Clay is separated from Alabama by the Chattahoochee river, which is here very wide, and is lined with high bluffs along nearly the whole length. The county is included in the oak, hickory, and pine and red hills regions. Its surface is hilly and broken along the river, but more level on the east.

On the extreme north the hills are covered with dark sands, underlaid by yellow or variegated clays. Ferruginous sandstone and iron ores are abundant on some of the hills, giving their soils a yellow or red color. The river valley here is wide, level, and some 25 or 30 feet above the river, and is generally under cultivation.

In the bluffs of this section of the river north of Pataula creek, and in those of the creek itself for a short distance, are blue micaceous fossiliferous clay marls (Cretaceous) with ledges of limestone. These are well exposed at the "Narrows", a beautiful waterfall over one of these rocky ledges into the soft marl bed below. These blue marls a short distance below the mouth of the creek disappear below the water's surface, and are replaced or covered in the bluffs by white marls and limestones (Tertiary). An analysis made of the Pataula creek marl shows but about 8 per cent. of carbonate of lime, the rest of the ingredients being chiefly sand and clay. (See page 45.)

Southward from the creek the country is slightly rolling, and a few lime-sinks occasionally occur. The limestone underlying the land shows in the river an outcrop of at least 20 feet, and is hard and massive. It also dips under the water, and is covered in turn by a white friable marl (Claiborne), which still southward forms high bluffs, extending into the Early county section of the river.

Fort Gaines is situated on a bluff about 125 feet above the river. (See page 14.) The white marl here rises 15 feet above the water, and is covered by about 60 feet of alternate strata of blue fossiliferous clays and blue marls, and on top of this 50 feet of a reddish clay loam. These blue shelly clays have been used with advantage on the sandy lands of the Alabama side of the river, but are not as rich as the white friable marls and limestone below them, which contain over 80 per cent. of carbonate of lime.

On the bluffs large fragments of silicified wood are frequently found, and silicified shells and shell-rock occur in the southern red hills of the county.

The growth of the river uplands is pine, red oak, hickory, and black-jack.

The eastern part of the county is rather open and undulating, and has a growth chiefly of pine and a sandy soil, with ferruginous pebbles and fragments of silicified shell-rock. (See analysis of soil, page 40.)

All of the lands of the county are considered tillable, and 42.2 per cent. are under cultivation, chiefly in cotton and corn. The former embraces 39.9 per cent., and averages 107.7 acres per square mile, the county in this regard ranking as eleventh in the state. The average product per acre is very low, there being but eight counties having a less average. Negroes are here, as elsewhere in the region, the chief cotton producers.

ABSTRACT FROM THE REPORT OF F. K. FREEMAN, OF FORT GAINES.

The lowlands are not preferred for cotton, though they seem to produce more fruit to the plant. The uplands vary from gray and light to dark-gray sandy soils, with red clays in an easterly direction. The *gray sandy lands* prevail, with clay on the ridges and eastern slopes, after going half a mile east from the river. They comprise five-sixths of the county area; have a growth of yellow pine, cedar, and black-jack, a sandy, gravelly loam soil, 6 inches deep, and a red or light-yellow clay subsoil.

The crops of the county are corn, oats, sweet potatoes, and cotton. Cotton on fresh land yields 1,000 pounds per acre, and after six years' cultivation 800 pounds of seed-cotton, 1,485 pounds of which in each case make 475 pounds of lint. The plant grows 3 feet high, and runs to weed on bottom lands unless restrained by fertilizers. The most troublesome weeds are coffee-weed, cocklebur, and crab-grass. Very little land once cultivated now lies out, for, by the application of manures, they produce finely. Serious damage is done by the washing of the soils, and the valleys are injured very materially. Only feeble attempts are made to check the damage, but the results are satisfactory.

In October, November, and December cotton is shipped, by railroad and by river, to Savannah, Columbus, and New York, the rates being 50 cents per bale to Columbus and 50 cents per 100 pounds to Savannah.

CALHOUN.

Population: 7,024.—White, 2,354; colored, 4,670.

Area: 280 square miles.—Woodland, all; lime-sink (wire-grass) region, 3 square miles; oak, hickory, and pine uplands, 277 square miles.

Tilled lands: 57,804 acres.—Area planted in cotton, 24,429 acres; in corn, 19,642 acres; in wheat, 198 acres; in oats, 5,526 acres; in rye, 12 acres.

Cotton production: 4,670 bales; average cotton product per acre, 0.19 bale, 273 pounds seed-cotton, or 91 pounds cotton lint.

Calhoun county is well timbered, and is watered by the Chickasawhatchie and Ichawaynochaway creeks and their tributaries. The surface of the country is undulating or slightly rolling, and the lands are varied. On the north are the "oak and hickory lands", or yellow loam and red clay lands, with long-leaf pine. Southward the latter growth becomes more and more abundant, the country more open, and lime-sinks occur frequently.

On the extreme south wire grass and very open long-leaf pine areas extend into the county from the south.

A white and soft limestone underlies the entire county, through which underground streams have cut their passage, appearing frequently for short distances and as suddenly disappearing.

Buhr-stone or siliceous shell-rock and flint are found in fragments all over the county. Swamps are numerous, and those considered as irreclaimable comprise 5 per cent. of the area of the county.

The crops embrace corn, cotton, oats, sugar-cane, rice, peanuts, and chufas. Lands under tillage comprise 32.3 per cent. of the total area, and of these 42.3 per cent. are in cotton, the chief crop. The average of cotton acreage is 87.2 acres per square mile. In product per acre the county is very low, ranking only above Baker, Mitchell, and Glynn counties. The negro population here is about double that of the whites, while as laborers the proportion is far greater.

ABSTRACT FROM THE REPORT OF W. A. BECKCOM, OF ARLINGTON.

But a small quantity of lowland is cultivated in this county. The cotton lands may be classed as gray sandy uplands, red stiff uplands, and black sandy loam or hummock, the last being considered the best for cotton.

The *gray sandy lands* comprise two-thirds of the area of the county, and have a growth chiefly of pine, with some few oaks. The soil is about 5 inches deep, with a yellow, then red clay subsoil. It contains much soft, rounded, black ferruginous gravel. The land is best adapted to cotton and oats, but corn, sugar-cane, rice, ground-pease, and chufas are produced. Cotton comprises about one-half the crops, grows to a height of 4 feet, and yields about 1,000 pounds of seed-cotton per acre when fresh. The stalk runs to weed on fresh and rich land and when planted too close. To prevent this it is thinned when young and fertilizers are applied. After a few years' cultivation the yield is diminished to 300 or 500 pounds of seed-cotton per acre; 1,545 pounds make 475 pounds of lint from both fresh and old lands, but the staple on the latter is not as long as from the other. Coffee-weeds and cocklebur are most troublesome. One-third of the lands once under cultivation now lies out. When again taken into cultivation and fertilized it makes better cotton than any other land. But little damage is done to uplands or valleys by the washing of the soils. The lowlands, when well drained, are the best.

Shipments of cotton are made by railroad to Savannah at 80 cents, and to New York at $1 45 per bale.

DOUGHERTY.

Population: 12,622.—White, 1,952; colored, 10,670.

Area: 340 square miles.—Woodland, all; lime-sink (wire-grass) region, 194 square miles; oak, hickory, and pine uplands, 146 square miles.

Tilled lands: 85,885 acres.—Area planted in cotton, 40,996 acres; in corn, 23,263 acres; in wheat, 116 acres; in oats, 6,052 acres; in rye, 19 acres.

Cotton production: 9,736 bales; average cotton product per acre, 0.24 bale, 339 pounds seed-cotton, or 113 pounds cotton lint.

Dougherty county is divided into two equal portions by Flint river, and is bounded on the west by Chickasawhatchie creek. It is a rolling country, lying partly in the wire-grass and partly in the oak and hickory region, and is entirely underlaid by white limestone, outcrops of which occur in the streams and also furnish large springs. Blue spring, south of Albany, the largest of these, has a depth of 25 or 30 feet, and the water is very clear, allowing small objects to be distinctly seen at the bottom. The limestone forms the walls of the spring.

Buhrstone is also abundant, occurring often in large masses. Its position is above the limestone, as shown at the mouth of Fowltown creek north of Albany, where it shows a thickness of 10 feet. Lime-sinks occur frequently in various parts of the county.

The wire-grass region, or its lime-sink division, covers all of the country from the north county-line westward 2 miles beyond Albany, and thence southward to about the corner of the county. Long-leaf pine is almost the only growth on the uplands, the surface of the county being very open, and covered with wire-grass, interspersed with cypress ponds. The lands are sandy, with clayey subsoils, and are rather sparsely settled away from the river and from Albany. The rest of the county on the west of this region is of the yellow loam and red clay uplands character. The region begins 2 miles west of Albany, has a growth of oak and hickory, with much long-leaf pine, and a better character of lands than on the east; red clay lands predominate, though they have often a thin covering of sand.

The irreclaimable swamps of the county comprise 10 per cent. of its area; of the rest, 75 per cent. has probably been cleared.

Tilled lands embrace 39.5 per cent. of the total area, and of these 47.7 per cent. are in cotton. Dougherty is one of the chief cotton counties of the state in the average acreage of that crop (120.6 acres) per square mile, the county ranking as fifth. Its low product per acre, however, brings the number of bales per square mile (28.6) also very low.

ABSTRACT FROM THE REPORT OF MESSRS. WELCH AND BACON, OF ALBANY.

The lands of the county are classed as light sandy loam and red mulatto.

The *light sandy soil* comprises three-fourths of the county, and extends from 15 to 50 miles east and only a few miles west of Albany. The growth is pine. The soil has a depth of 7 inches, with mostly a sandy hard clay subsoil. Limestone underlies it at from 15 to 20 feet. The soil is easily tilled at all seasons, and is early, warm, and well drained by underground lime-sinks and streams. The crops of the county are cotton, corn, oats, sugar-cane, sweet potatoes, pease, and upland rice. Cotton, to which the lands are best adapted, comprises five-eighths of the crops, and grows 3 feet high, runs to weed in wet seasons unless topped, is troubled most with grass, and yields on fresh land about 800 pounds of seed-cotton per acre, 1,600 pounds making 475 pounds of lint rating as low middling. On land five years in cultivation the yield is 500 pounds, the lint rating as strict ordinary. About 25 per cent. of these lands now lie turned out, and improve by two or three years rest. The lands do not wash.

The *red mulatto clay lands*, comprising one-fourth of the county area, extend 15 or 20 miles west of Albany, and have a growth of oak and hickory. The soil is 8 inches deep, with a heavy impervious red-clay subsoil; it is early, warm, but ill drained, and easy to till, and is best adapted to cotton and corn. Cotton comprises five-eighths of the crops, grows 3 feet high, and yields 1,000 pounds of seed-cotton per acre on fresh land; it rates as low middling. On land ten years in cultivation the yield is 700 pounds, and the staple is strict good ordinary. About 10 per cent. of this land lies turned out. It produces better by rest and washes but little. Gullying is easily prevented by horizontalizing.

Between the months of September and February cotton is shipped by rail to Savannah at about $3 per bale.

BAKER.

(See "Lime-sink and wire-grass region".)

EARLY.

Population: 7,611.—White, 3,015; colored, 4,596.

Area: 510 square miles.—Woodland, all; oak, hickory, and pine uplands, 307 square miles; lime-sink (wire-grass) region, 203 square miles.

Tilled lands: 42,276 acres; area planted in cotton, 20,552 acres; in corn, 17,624 acres; in wheat, 39 acres; in oats, 4,750 acres.

Cotton production: 4,270 bales; average cotton product per acre, 0.21 bale, 297 pounds seed-cotton, or 99 pounds cotton lint.

Early county is separated from Alabama on the west by the Chattahoochee river. The surface of the country is rolling on the north, but becomes more level southward to the wire-grass region. The county is underlaid by limestone, and lime-sinks occur frequently. The rock outcrops in the banks of the river as far south as Columbia, and also in the various streams west of Blakely. Large masses of flint and siliceous shell-rocks are scattered over the entire county, but are most abundant in the southern portion.

The red clay lands extend for a mile or two into Early, on the northwest, near the river. South to Blakely, and 4 miles beyond, the yellow-loam lands prevail. The soil is sandy, with a yellowish clayey subsoil; growth, chiefly pine, with some oak and hickory. Cypress ponds are interspersed throughout. The limit of this yellow-loam region extends from 5 miles south of Arlington to 4 miles south of Blakely, and on to a few miles south of Columbia, on the Alabama side of the river. The growth of the entire country is very open.

The lower part of the county is covered with wire-grass and long-leaf pine, interspersed with a "blue-jack" undergrowth, the surface level, and the roads hard.

The swamps and lowlands of the county comprise a large proportion of the area, those irreclaimable being 5 per cent. of the surface.

The country is sparsely settled (15 persons per square mile) and well timbered. Thirteen per cent. only of its area is under cultivation, and but 20 per cent. in all is said to have been cleared, thus leaving 80 per cent. of the original growth still standing. Cotton and corn are the chief crops, the former embracing 48.6 per cent of the tilled lands, placing the county as fifth in the state in this regard.

The cotton average is 40.3 acres per square mile, and its product per acre is the same as that of Clay, Miller, and Morgan, and only above five other counties of the state.

ABSTRACTS FROM THE REPORTS OF J. B. MULLIGAN AND DENNIS M. WADE, OF BLAKELY.

The lands of the county are generally level, but sometimes rolling, and are classed as gray, red or stiff, and lowland.

The *gray sandy lands* comprise fully two-thirds of the lands of the county, and the soil is 5 inches deep, with a subsoil of red stiff or soft yellow clay. These lands are easy to cultivate in all seasons, are early and well drained, and have a growth mostly of pine and wire-grass. The crops of the county are corn, cotton, oats, sweet potatoes, ground-pease, chufas, rice, and sugar-cane. Cotton comprises one-half the crops, grows 2½ feet high, and runs to weed on fresh land in wet seasons unless restrained by a liberal use of fertilizers. Fresh lands yield 500 pounds of seed-cotton per acre. After cultivation of fifteen years the yield is 300 pounds, and the lint is generally shorter. Crab-grass is most troublesome. One-third of the land now lies turned out, and after resting it produces better than originally. It washes readily, but no damage is done.

The *red or stiff lands*, comprising two-ninths of the county area, have a growth of beech, hickory, oaks of all kinds, magnolia, cedar, poplar, etc. The soil is 6 inches deep, with a subsoil more or less hard, as indicated by the growth. It is early and well drained, and is best adapted to corn and wheat. Cotton comprises one-third of the crops, grows 3 feet high, and yields 600 pounds of seed-cotton on fresh land and 300 on land fifteen years under cultivation. Crab-grass is most troublesome. One-fourth of the land lies turned out, which produces as well when again cultivated.

The *swamp and river bottoms* comprise one-ninth of the lands of the county. These have a gum and cypress growth, a fine sandy soil from 18 to 36 inches deep, and when ditched are best adapted to corn. One-fourth is planted in cotton. The plant grows from 4 to 6 feet high, and yields 1,000 pounds of seed-cotton per acre when fresh and after fifteen years' cultivation. One-fourth of the land now lies turned out, which produces as well as ever when again taken in.

Cotton is shipped, as soon as ready, by railroad and by river to Columbus and to Savannah.

SOUTHERN OAK, HICKORY, AND PINE UPLANDS.

(Embraces parts of the counties of Decatur, Thomas, and Brooks.)

DECATUR.

Population: 19,072.—White, 8,889; colored, 10,183.

Area: 1,160 square miles.—Woodland, all; lime-sink (wire-grass) region, 833 square miles; southern oak uplands, 327 square miles.

Tilled lands: 79,219 acres; area planted in cotton, 29,509 acres; in corn, 30,847 acres; in wheat, 22 acres; in oats, 9,282 acres; in rye, 6 acres.

Cotton production: 6,396 bales; average cotton product per acre, 0.22 bale, 309 pounds seed-cotton, or 103 pounds cotton lint.

Decatur is the most southwesterly county of the state and also one of the largest. Chattahoochee river separates it from Florida on the west, while Flint river, after flowing in a southeasterly course across the county, unites with the former river, the point of junction being the western terminus of the southern boundary-line of the state.

The county is well timbered, mostly with a tall growth of long-leaf pine. Limestone underlies the entire country, outcropping in many places, and showing its presence in others by lime-sinks. The most noted of the latter is on the northeast. It has a depth of 105 feet, with a diameter of about 50 yards, the soft white limestone being exposed all the way down. A stream of water falls into it from the surface and disappears. A large cave has also been formed in the side of this sink, and a number of what are termed "blowing caves" occur in this section. Spring creek, on the western side of the county, derives its name from the large number of springs that supply the water. These springs come up through the limestone, frequently cover large areas, and are very deep.

The agricultural regions represented in this county are the wire-grass (lime-sink division) and southern oak, hickory, and pine uplands. The former covers the northern part of the county, extends 7 miles south of Bainbridge, and includes two classes of lands, designated, by the character of their subsoils, as clay lands and sandy lands. The clay lands cover the eastern half of that portion of the county lying between the Flint river and the Thomas county-line, and extend southward to the railroad. Another area is on the west of Spring creek, reaching half way to the Chattahoochee river. Clay underlies it at depths of 4 to 24 inches. The soil is sandy, and covered with wire-grass in abundance, and the country is very open and undulating. The sandy lands of this upper section lie on each side of Flint river for many miles, and also along the Chattahoochee on the northwest. They are very level and open, and are interspersed with a few lime-sinks and cypress ponds. The hummock lands are extensive and productive, though not durable. (See analysis, page 43.)

Siliceous shell-rock is found in abundance along the river banks and in fragments on the upland. The rock, on decomposition, forms a light white or reddish powder. Limestone (Vicksburg) underlies it at Bainbridge.

Live-oak trees form the chief growth around this town, and southward 7 miles to the hills there is much oak undergrowth.

The oak, hickory, and pine uplands occupy a high ridge across the county from near Fowltown, on the Chattahoochee river, southward to the mouth of Spring creek, thence up Flint river to 7 miles south of Bainbridge, and turning east and northeastward to and beyond Climax, 9 miles east of Bainbridge, into Thomas county. The elevation of this ridge is 315 feet above the sea, 130 above the river, or 75 above the pine lands, and is rather abrupt on the north.

In the northern part of this southern region red clays form a portion of the lands. To the south the country becomes more sandy and broken, and long-leaf pine forms a very prominent growth. The soil is rather thin, over a red or yellow clay subsoil and a pipe-clay. Limestone containing some calc-spar also underlies this, outcropping in the banks of the streams. At the foot of the ridge, and apparently underlying this limestone, is found the siliceous shell-rock of the wire-grass counties.

The following abstracts give the features and productiveness of these various lands. Outside of the town of Bainbridge, the county is but thinly settled.

One per cent. of the lands is irreclaimable swamp; 10.7 per cent. is under cultivation. Of these tilled lands, 37.3 per cent. is in cotton, which has an average of 25.4 acres per square mile. The average product per acre is very low, the county ranking above but nine counties of the state in this regard.

ABSTRACT FROM THE REPORT OF JOHN E. DICKENSON, OF BAINBRIDGE.

The cotton lands of the county are the pine lands, river lands, creek hummock lands, and what are generally known as *clay lands*. Beginning on the northern portion of the eastern side of the county, these lands extend westward some 12 or 14 miles, running entirely across the county north and south. About half way down this line, 18 miles from the northeast corner, the lands widen rapidly until they reach the river, and extend down its banks to the lower edge of the county. Inside of this boundary-line there are spots here and there that are sandy, with clay from 4 to 12 inches under the surface. West of Spring creek, between Flint and Chattahoochee rivers, there is a strip from 5 to 8 miles wide across the county. Here the subsoil of clay is from 12 to 24 inches below the surface. Much the larger portion of these clay lands has a pine growth.

The *pine lands*, with their fine sandy soils from 3 to 5 inches deep, cover four-fifths or nine-tenths of the county, and have a long-leaf pine growth. The subsoil is generally lighter than the soil. The crops of the county are cotton, corn, oats, pease, potatoes, and sugar-cane. These lands are easy to till, early, warm, well drained, and best adapted to oats, though one-half of the plowed or hoed crops is of cotton. The yield in seed-cotton on land four years under cultivation is from 600 to 800 pounds per acre, 1,665 pounds of which make 475 pounds of lint. Cotton grows from 2½ to 4 feet high, and runs to weed on fresh land in very wet seasons. Crab-grass is most troublesome.

The *creek and hummock lands* have a growth of oak, hickory, ash, magnolia, poplar, and various undergrowth. The soil is a fine sandy loam from white to yellow and mahogany in color, and has a depth of 6 inches, with a clay subsoil. These lands are not as durable as the bottoms. The fresh lands are good for tobacco and afterward for any other crop. This land is easy to till, late, cold, and ill drained. Cotton comprises one-half the crops, and grows to a height of 5 or 6 feet, producing from 1,000 to 1,200 pounds of seed-cotton per acre. Very little of this land lies out. It is injured in some places by washing, which can be prevented by horizontalizing and hillside ditching.

The *river bottoms* cover but a small proportion of the county in a narrow strip bordering the rivers. The timber is oak, hickory, walnut, magnolia, dogwood, and a great variety of smaller growth. The soil is a dark and fine loam, 1 foot or 2 feet in depth, underlaid by a clay. It is early, cold, and ill drained, and good for any crop. Cotton comprises one-half the crops, and grows from 6 to 7 feet high, producing from 1,200 to 1,800 pounds in the seed for a number of years; 1,545 pounds are required for 475 pounds of lint. Cockleburs and morning-glory vines are most troublesome. None of the land lies turned out.

Cotton on all wet lands is late and subject to rust, and is apt to shed its leaves and fruit.

Planters sell their cotton to local merchants, and it is then shipped to Savannah by railroad at 75 cents per 100 pounds.

THOMAS.

Population: 20,597.—White, 8,384; colored, 12,213.

Area: 780 square miles.—Woodland, all; lime-sink (wire-grass) region, 312 square miles; southern oak, hickory, and pine uplands, 468 square miles.

Tilled lands: 89,760 acres.—Area planted in cotton, 35,895 acres; in corn, 35,839 acres; in wheat, 34 acres; in oats, 18,281 acres; in rye, 19 acres.

Cotton production: 8,773 bales; average cotton product per acre, 0.24 bale, 348 pounds seed-cotton, or 116 pounds cotton lint.

Thomas county is well timbered with a tall growth of long-leaf pine on the uplands and magnolia, bay, oak, and hickory along the creeks and Ocklockony river. Limestone underlies the entire county, outcropping in numerous places, and producing lime-sinks over the northern portion.

Along the Florida line the country is rolling, and the ridges are covered with ferruginous gravel. The soil is a red sandy clay from 4 to 5 feet deep, with underlying light or variegated-colored joint-clay. The growth is chiefly pine, with gum and white oak and a small undergrowth of gum. The siliceous shell-rocks peculiar to the lime-sink region are found in wells 40 feet from the surface.

Northward to Thomasville the pine becomes more exclusive and larger, and black-jack becomes a prominent feature to within 3 miles of town, the lands being sandy and filled with ferruginous gravel or bog ore. (See analysis, page 43.)

North from Thomasville, and also eastward, are the comparatively level lands of the wire-grass region, with its clay subsoils, long-leaf pine growth, "lime-sink" depressions, and buhr-stone or siliceous shell-rock fragments. The position of the latter with regard to the limestone is there shown. On the river 4 miles north of Thomasville limestone, 12 feet thick, is exposed in the banks, while on the surface the flinty shell-rocks form a solid stratum some 4 feet thick. Of the county area 2 per cent. is irreclaimable swamp; 18 per cent. is under cultivation in cotton and corn, with a slight difference in acreage in favor of the former crop. Cotton has an average of 46 acres per square mile. The product per acre is low. It is thought that 33 per cent. of the lands suitable for tillage have, from time to time, been cleared of their original timber growth.

ABSTRACTS FROM THE REPORTS OF R. H. HARDAWAY, OF THOMASVILLE, AND JAMES H. HAYES, OF CAIRO.

Good uplands are much preferred for cotton, because of the certainty of making a crop. On the lowlands cotton matures later, and is liable to overflow and also to the boll-worm. The lands may be classed as gray loam, black loam, and chocolate lands, all with impervious red-clay subsoils.

The *gray sandy and gravelly lands* comprise two-thirds of the county, and have a growth of yellow pine, with hickory, oak, ash, cherry, maple, magnolia, cedar, and red bay. The soil has a depth of from 12 to 15 inches, is easy to till in wet or dry seasons, and early, warm, and well drained (being a hilly country). The crops are cotton, corn, rice, sugar-cane, potatoes, oats, wheat, fruits, and melons. The gray lands are best adapted to small grain and cotton. The latter comprises one-half the crops, and yields on fresh land 600 pounds in the seed per acre, the lint rating as middling. After five years' cultivation the yield is from 300 to 400 pounds, and the lint is not so soft, silky, or long. Cotton grows from 2 to 7 feet high, but is most productive at 3 or 4 feet, and runs to weed with too heavy manuring and too much rain. Light manuring, early planting, and topping prevent this tendency and favor bolling. Cockleburs, coffee-weeds, crab-grass, or crowfoot are most troublesome. One-third of the land now lies out, and when again taken is almost equal to the virgin soil. It washes readily, but does no serious damage if properly ditched. On the west of the county the damage is serious, and the valleys are also much injured, though some effort has been made to check it.

Cotton is shipped from Thomasville by railroad to Savannah at $3 50 per bale.

BROOKS.

Population: 11,727.—White, 5,670; colored, 6,057.

Area: 530 square miles.—Woodland, all; lime-sink (wire-grass) region, 293 square miles; southern oak, hickory, and pine uplands, 237 square miles.

Tilled lands: 75,962 acres.—Area planted in cotton, 21,255 acres; in corn, 23,027 acres; in wheat, 46 acres; in oats, 14,087 acres; in rye, 161 acres.

Cotton production: 6,288 bales; average cotton product per acre, 0.30 bale, 423 pounds seed-cotton, or 141 pounds cotton lint.

Brooks county lies on the Florida line, is well timbered with long-leaf pine, oak, and hickory, and is, with the exception of the northeastern corner and a strip of land on the north, included in the oak, hickory, and pine region of the southwest and Florida. Little and Withlacoochee rivers and Ocopilco creek are the chief streams, all uniting on the east.

The oak and hickory region comprises the best lands of the county. Along Mule creek, some 15 or 20 miles north of Quitman, the country is broken, the hills being some 50 feet or more above the streams and covered with a hard light-red clay soil containing ferruginous gravel. The growth of these hills is red, white, and post oak, hickory, and a scrub-oak undergrowth. The subsoil is a yellowish clay, with some 30 feet of a "calico" or spotted underclay. (See analysis of soil from Ocopilco, page 43.)

These hills give way to pine and level lands 8 miles north of Quitman, which extend southward for some distance. Three miles north of Quitman there is a fall of some 50 feet to a flat, on which cypress ponds are very abundant; but southward to the Florida line the county again becomes rolling, with open long-leaf pine growth, some oak and hickory, and a little wire-grass. Cypress ponds are also numerous, and their white sand beds are covered with a muck deposit of several inches. Ferns grow luxuriantly on these lowlands. The lands of this section have a sandy soil with a yellow-clay subsoil. Limestone (Vicksburg) underlies the region, appearing only on the east of Quitman, at Blue or Mineral spring. Here, through a lime-sink, the clear water from an underground stream has found its way upward through the rock, and flows off in a regular channel into the river, affording 6,000 gallons per minute.

The wire-grass region of the northern part of the county is of the better class, or lime-sink division. The soil is sandy, with a clay subsoil, the country somewhat rolling, especially near the oak and hickory region, and the growth is almost exclusively long-leaf pine. Cypress ponds occur occasionally. The sand flats and lowlands are covered with a dense growth of saw-palmetto. Of the county area 10 per cent. is probably irreclaimable swamp land; 22.4 per cent. is under cultivation, though 37 per cent. is thought to have been cleared of its original growth. Corn is here the chief crop, its average being 43.4 acres, and that of cotton 40.1 acres per square mile.

ABSTRACT FROM THE REPORT OF R. I. DENMARK, OF QUITMAN.

The soils cultivated in cotton are the red clay, gray and sandy hummock, and pine soils.

The chief soil, commonly designated as *red clay soil*, is a gray soil with a red clay subsoil, and covers about 30 per cent. of the county, extending about 15 miles north, 30 south, 10 east, and 150 miles west. Its natural timber is red, white, and post oaks, hickory, and other hard-wood trees. This soil varies from a fine sandy to a gravelly loam, and in color from gray to yellow, orange, red, and blackish, and is 18 inches thick. The subsoil is a red clay, heavier than the surface soil, and contains soft "black gravel" and rounded pebbles, underlaid by gravel, and sometimes rock, at from 5 to 20 feet. Tillage is easy in dry seasons; the soil is early and warm, but only a portion is well drained. It is apparently best adapted to cotton and oats, but corn is also raised. About one-third of the cultivated area of this soil is planted in cotton. The plant attains a height of from 3 to 7 feet, but is most productive at from 3½ to 4 feet; it inclines to run to weed in wet seasons, and is best restrained by shallow cultivation and topping. The seed-cotton product per acre of this soil, when fresh, is from 1,000 to 1,500 pounds, the lint rating in market as middling. After six or eight years' cultivation (unmanured) the product is from 500 to 600 pounds of seed-cotton, of which about 1,545 pounds make a 475-pound bale of lint, which rates one or two grades below that from fresh land. The most troublesome weeds are beggar-weed, crab-grass, and in localities cockleburs. Very little of this land now lies turned out. It washes badly in some localities, but no serious damage is done, except to the valleys, which are injured 5 per cent. Hillside ditching and horizontalizing are very successful in checking this.

The second quality of soil bears yellow pine, and is designated as *pine land*. It extends from 50 to 100 miles to the north, northeast, and northwest. The soil is a fine sandy loam, varying in color from whitish-gray to yellow and brown, and is from 3 to 6 inches thick. The

subsoil is heavier than the surface soil, and contains soft "black gravel" and rounded pebbles, underlaid by clay at from 1 foot to 3 feet. This pine land is easily tilled in any season, and the soil is early and warm, but ill drained. It is best adapted to oats, sweet potatoes, and vegetables; but one-fourth of its cleared area is planted in cotton. The plant attains a height of from 3 to 4 feet, and the seed-cotton product per acre of fresh land is from 500 to 800 pounds, of which 1,365 to 1,425 pounds are needed to make a 475-pound bale of lint, which rates as good middling. After five years' cultivation the product is from 300 to 500 pounds, and 1,425 to 1,545 pounds are required for a 475-pound bale of lint, the staple rating one or two grades below that from fresh land. The most troublesome weed is crab-grass. Very little of such land once cultivated now lies turned out. The soil does not readily wash or gully on slopes. Washing is successfully checked by horizontalizing and hillside ditching. This pine land is now attracting attention, and will ultimately be brought into cultivation.

Cotton is shipped, as soon as ready, by rail to Savannah at $3 50 to $4 per bale.

LONG-LEAF PINE AND WIRE-GRASS REGION (LIME-SINK DIVISION).

(Counties of Screven, Bulloch,* Dodge, Dooly, Wilcox,* Worth, Lee,* Dougherty,* Baker, Early,* Miller, Decatur,* Thomas,* Mitchell, Colquitt, Brooks,* and Lowndes.)

SCREVEN.

Population: 12,786.—White, 6,173; colored, 6,613.

Area: 720 square miles.—Woodland, all; oak, hickory, and pine uplands, 97 square miles; pine barrens (wire-grass), 5 square miles; lime-sink (wire-grass) region, 618 square miles.

Tilled lands: 77,143 acres.—Area planted in cotton, 21,716 acres; in corn, 24,154 acres; in wheat, 69 acres; in oats, 3,502 acres; in rye, 7 acres.

Cotton production: 8,166 bales; average cotton product per acre, 0.38 bale, 537 pounds seed-cotton, or 179 pounds cotton lint.

Screven county, lying between the Savannah and Ogeechee rivers, has a surface generally rolling or undulating, though somewhat hilly in places, and all well timbered. The sandy lands, clay subsoil, and long-leaf pine growth of the wire-grass region covers nearly the entire county. Oak, hickory, and pine lands occur on the northeast corner and in a narrow offshoot from the main belt on the northwest, as well as along the borders of the creeks and rivers southward, where their width is from half a mile to one mile. The growth is chiefly long-leaf pine, with some oak and hickory. White marls and limestone underlie the entire county, and over this northern section siliceous shell-rock, buhr-stone, and flint are abundant in fragments on the surface or in beds several feet thick.

Lime-sinks are found in a narrow section of country extending from Millen in a northeast course to Mill Haven, some of them being quite large and deep.

The uplands in the vicinity of the rivers and Brier creek are better than those in the interior; the growth is also better, the long-leaf pine not being so prominent. The underlying marls outcrop in the high bluffs along the streams with a thickness of many feet, and are easily reached for purposes of fertilization of the land or conversion into slack lime. The beds of red and yellow clays that overlie these marls are in many places uncovered by the gradual slope of the uplands, and afford, by their admixture with the sand of the hills, areas of good farming land. These yellow-loam uplands extend southward in broken areas along the Savannah river into Effingham county, the growth changing somewhat.

The lands of the greater portion of the county are of the better class of pine and wire-grass lands, with usually yellow clay at depths of from 6 to 18 inches, though quite a proportion has yellow sandy subsoils. Long-leaf pine is almost the exclusive upland timber, and "turpentine farms" have largely utilized this pitchy growth. The trees stand at distances of from 50 to 100 or 200 feet apart, have little undergrowth, and the "turpentine boxes" cut into the sides of the tall bare trunks can be seen over large areas.

On the west, near the Ogeechee river, is a prominent point (Parramore's hill) 144 feet above the river, composed of sandstone (presumably equivalent to the Grand Gulf of Mississippi). The rock also outcrops in the bank of the river, but is too soft for building purposes. The sample of soil from these wire-grass lands taken for analysis (see page 48) does not represent the best class.

There are in various parts of the county hills of deep white sand, very unproductive, and fortunately covering but small areas. Sylvania, the county-seat, is situated on one of these sand-hills, which also is part of the ridge separating the tributaries of the two rivers. Of the area of the county 3½ per cent. is irreclaimable swamp. The bottom lands of the Savannah and Ogeechee rivers are wide and very rich, but more or less subject to overflow. The soil is a dark sandy loam, covered with a dense bottom growth.

Brier creek, in its lower and eastern course, has also rich valley lands, containing a very large amount of decayed vegetation (see analysis, page 49). These lands are largely under cultivation, though rather subject to overflow. The water of the creek is dark and blackish, as is also that of the smaller streams and flats.

A number of the ponds of the northeastern corner of the county were drained and cleared and put under cultivation before the war. Mobley's pond, the most noted of these, is 7 miles in circumference, and was put in cultivation at a cost of about $10,000. Large crops were produced for a number of years, but it was abandoned finally because of the great injury done to the lungs of laborers by the fine dust of the soil, apparently formed from siliceous sponge spicules, as explained on page 44 of the general part.

In the lower half of the county there are abundant small flats or cypress and bay ponds having other low swamp trees and gallberry bushes along the margins. The noted "Georgia bark", or *Pinckneya pubens*, is a prominent growth of the smaller streams.

Screven county is sparsely settled with an average of eighteen persons per square mile. Lands under cultivation embrace 16.7 per cent. of the total county area. Corn is the chief crop, its average being 33.5 acres, while that of cotton is 30.2 acres per square mile, or 28.2 per cent. of the tilled land. The average product per acre is quite high, far above the counties of the central belt and the majority of those of the metamorphic region, the county ranking thirtieth in the state.

ABSTRACT FROM THE REPORT OF HON. GEORGE R. BLACK, OF SYLVANIA.

The surface of the country is partly level, partly hilly, partly rolling, the soil varying from sandy to stiff pebbly, with clay subsoil, and, along the rivers, stiff clay soil.

The bay bottom lands produce cotton finely for three or four years after clearing and first cultivation, but afterward the cotton, growing off finely in the spring, is almost certain to be affected with rust before maturity. The sandy lands do not produce well, but the more generally prevailing stiffer sandy soils with clay subsoils produce cotton finely, especially when fertilized. All are, however, at times subject to rust, but never so badly as to prevent the production of a fair crop. The cotton lands of the county may be classed as (1) clay lands on the margin of the rivers and clay and sand mixed; (2) stiff sandy lands with clay subsoil; (3) sandy lands and reclaimed pond bottoms. The good and poor lands are intermixed throughout the county in bodies of from 10 to 100 acres, though some soils, in general aspect and growth of timber, extend for many miles.

The *stiff sandy lands* comprise one-tenth of the lands of the county. The soil, a brownish clay loam, is 1 foot deep; the subsoil is a clay without intermixture of sand, as is the surface soil, and is underlaid by clay. The lands contain hard, rounded black gravel. The growth is red oak, hickory, and dogwood. These lands are easily tilled in all seasons, are early, warm, and well drained, and produce crops of corn, cotton, sweet potatoes, sugar-cane, chufas, oats, rye, pease, and rice. Wheat is successfully raised here, but is subject to rust. Cotton comprises one-half the crops, grows from 2 to 6 feet high (the higher the better), and runs to weed on newly cleared land and in wet seasons. Bolling is facilitated by the use of fertilizers. Fresh lands produce from 500 to 750 pounds of seed-cotton per acre, the lint rating as low middling. Cultivation of eight years reduces the yield to 400 pounds, and the lint is not quite so good. The staple depends upon the seasons and the variety of the cotton. Crab-grass is the most troublesome weed. One-third of the land once under cultivation now lies turned out, and is generally thereby recuperated. These clay loam lands are generally so level that they do not wash.

The sandy, and in some places gravelly, *pine and wire-grass lands*, having clayey and leachy subsoils at from 1 foot to 2 feet, comprise about 75 per cent. of the lands of the county. They contain much black ferruginous gravel, are underlaid by clay indefinitely, and are best adapted to corn, cotton, potatoes, pease, etc. Cotton grows 4 feet high, yields 500 pounds of seed-cotton per acre on fresh land and 350 pounds after eight years' cultivation, the lint rating as low middling in each case. With 200 or 400 pounds of guano per acre the yield with good management is 1 or 2 bales per acre. Ten per cent. of the lands now lie turned out, and are much improved. They wash readily, but no damage is done. Hillside ditching is practiced successfully to a limited extent.

The *white sandy uplands*, from 5 to 10 feet deep and underlaid by clay, comprise but 10 per cent. of the county lands, and are found in spots of not more than a mile in each direction. The growth is black-jack oak and pine. The soils are best adapted to pease, corn, chufas, and potatoes, though 10 per cent. of the crops is cotton, which grows only 1 foot or 2 feet high. The yield on fresh land is only 100 pounds of seed-cotton per acre, or 300 pounds after eight years' cultivation, the lint from each rating as good ordinary.

The *black mucky lands* of Brier creek are similar to the bay lands already mentioned as regards cotton. For corn they are famous, producing very fine crops for a long series of continuous years without fertilization. They are from 1 foot to 3 feet deep, underlaid by sand or pipe-clay; growth, cypress and black gum chiefly.

ABSTRACT FROM THE REPORT OF R. D. SHARPE, OF PARRAMORE'S HILL.

The lands of the county may be classed as sandy or loamy, with stiff or clay bottoms and red gravel land, oaky ridges and flats, river bottoms, and drained ponds.

The *clay subsoil lands* comprise 60 per cent. of the county area, with a growth of long-leaf pine, post oak, and round- and pronged-leaf black-jack. Red gravel is abundant in the soil. The land is best adapted to cotton and corn. Cotton grows 4 feet high, and is most productive at 5½ feet, but runs to weed in wet seasons and when planted late unless topped in full moon in July and August, and yields 300 pounds of seed-cotton per acre the first and 400 pounds the second year, 1,365 pounds of the second year's growth making 475 pounds of lint, the staple then rating one grade higher, viz, low middling. One-third of this land now lies out. It washes readily on slopes, injuring the valleys 40 per cent., and is successfully checked by horizontal plowing, though only a few farmers attempt it.

The *sandy lands*, with a growth of pine, black-jack, sweet gum, and wire-grass, comprise 50 per cent of the lands, and yield 300 pounds of seed-cotton per acre the first and 350 pounds the second year, 1,395 pounds from the latter making 475 pounds of lint. Hog-weeds are most troublesome. Twenty per cent. of the lands originally cultivated now lie turned out, and are improved 25 per cent. over original soil.

The *river bottoms*, comprising 10 per cent. of the lands of the county, have a growth of pine, water oak, hickory, black gum, maple, ash, poplar, and cypress. Cotton on this land comprises 20 per cent. of the crops, grows 5 feet high, is most productive at 4 feet, and yields 500 pounds of seed-cotton per acre the first and 600 pounds the second year, 1,544 pounds of the first and 1,485 pounds of the second making 475 pounds of lint, rating respectively as good ordinary and low middling. Crab-grass, butter-weed, and crowfoot-grass are most troublesome. Ten per cent. of the lands originally cultivated now lie out and are much improved.

Shipments of cotton are made to Savannah, as fast as ginned, either by Savannah river boats or by railroad, as most convenient. Freight by boat is 75 cents per bale; by railroad, 25 cents per 100 pounds.

BULLOCH.

(See "Wire-grass and pine barrens region".)

DODGE.

Population: 5,358.—White, 3,506; colored, 1,852.

Area: 580 square miles.—Woodland, all; oak, hickory, and pine uplands, 30 square miles; lime-sink (wire-grass) region, 417 square miles; pine barrens (wire-grass), 133 square miles.

Tilled lands: 23,471 acres.—Area planted in cotton, 6,002 acres; in corn, 9,132 acres; in wheat, 23 acres; in oats, 2,054 acres.

Cotton production: 1,916 bales; average cotton product per acre, 0.32 bale, 456 pounds seed-cotton, or 152 pounds cotton lint.

The surface of Dodge county is quite level, and is covered entirely with long-leaf pine and wire-grass, the growth being very open and the timber tall, furnishing excellent lumber. The drainage of the county is to the Ocmulgee river, the western boundary; but the streams of the eastern part of the county do not unite with it until near its junction with the Oconee, in Telfair county.

Both divisions of the wire-grass region are represented in this county. The "lime-sink" and siliceous shell-rock division comprise the lands north of a line extending from near the southwest corner to 4 miles northwest of Eastman, and thence to the northeast corner. Hard, white limestone underlies this area, and is exposed in the banks of the various streams and as far south as Abbeville, on the river, though not continuously. Siliceous shell-rock also occurs frequently. The surface of this section is undulating, and the soils sandy and gray, with clayey subsoils. Much ferruginous gravel or pebbles is intermingled with the land.

On the southeast of this area the soils are of the poorer class of wire-grass lands, and are underlaid by sandy subsoils and an argillaceous sandstone a foot or two in thickness. This latter is exposed in the excavations along the railroad.

The county is very sparsely settled, the average being but 9 persons per square mile. It is thought that about 15 per cent. of the county area has been cleared, but only 6.3 per cent. is now under cultivation, and is chiefly devoted to corn. Cotton embraces 25.6 per cent. of tilled land, and averages but 10.3 acres and 3.3 bales per square mile. It is produced more generally in the northern part of the county, and fertilizers are used extensively to increase the yield. Five per cent. of the county is irreclaimable swamp. Lumber and turpentine industries largely occupy the attention of the people.

The Macon and Brunswick railroad and the Ocmulgee and Altamaha rivers afford easy transportation to the coast at Brunswick and Darien.

ABSTRACT FROM THE REPORT OF DAVID SAPP, OF DUBOIS.

The lands of the county are all *gray and sandy*, and the growth pine and wire-grass. The crops are corn, cotton, sweet potatoes, and cane. The sandy lands are best for potatoes and cane, the gravelly for cotton and corn. Cotton grows from 2 to 4 feet high, and when planted without fertilizers it grows taller but yields less. The yield on fresh lands is from 500 to 800 pounds of seed-cotton per acre, and that from land three years in cultivation is from 200 to 500 pounds, the staple of which rates as low middling. That from fresh land rates as middling, and in both cases 1,425 pounds make 475 pounds of lint. Crab-grass gives the only trouble. None of these lands now lie turned out; they wash readily on slopes, but are too level to be much injured, but the valleys are benefited.

Cotton is shipped by railroad, from October to January, to Macon and to Savannah at 50 cents per 100 pounds.

DOOLY.

Population: 12,420.—White, 6,592; colored, 5,828.

Area: 780 square miles.—Woodland, all; oak, hickory, and pine uplands, 128 square miles; lime-sink (wire-grass) region, 652 square miles.

Tilled lands: 117,113 acres.—Area planted in cotton, 38,495 acres; in corn, 40,334 acres; in wheat, 1,569 acres; in oats, 9,522 acres; in rye, 122 acres.

Cotton production: 9,666 bales; average cotton product per acre, 0.25 bale, 357 pounds seed-cotton, or 119 pounds cotton lint.

Dooly county is somewhat rolling, especially on the west, and is well timbered throughout. The water-shed between the Atlantic and the Gulf passes through the county in a southeasterly course. With the exception of the northwest corner, the county is included in the lime-sink division of the wire-grass region. This region extends north to within 2 miles of Henderson and 10 miles west of Vienna.

Lumpkin's creek, flowing from Henderson, in the south of Houston county, southwest to Flint river below Drayton, very nearly marks the limit of the region in this section. The lands of the yellow-loam region cover the country northwest of the creek from Houston to Sumter with a thin growth of oak, hickory, and pine.

Along the river outcrops of white limestone and marls occur, and the same rock underlies the entire county. It is overlaid by the siliceous shell-rocks, whose scattered fragments are found on the surface throughout the county. The lands of this western yellow-loam region are the best in the county, and the country is more thickly settled than on the east.

The wire-grass region is very open, its growth of long-leaf pine having but little undergrowth, with only scattered patches of oak and hickory. Its sandy soils and clay subsoils have usually the brown ferruginous pebble or gravel which occurs frequently over the southern part of the state, and which is indicative of a better class of land.

Cypress swamps, with thin, sandy, and mucky soils, and gallberry flats are abundant. Irreclaimable swamps comprise 2½ per cent. of the area of the county, and only 28 per cent. of tillable lands have been cleared. Lumber interests are important. Lands under tillage embrace 23.5 per cent. of the county area, corn and cotton being the chief crops, with averages respectively of 51.7 and 49.4 acres per square mile.

DOUGHERTY.

(See "Central cotton belt".)

BAKER.

Population: 7,307.—White, 1,742; colored, 5,565.

Area: 340 square miles.—Woodland, all; oak, hickory, and pine uplands, 32 square miles; lime-sink (wire-grass) region, 308 square miles.

Tilled lands: 66,767 acres.—Area planted in cotton, 28,670 acres; in corn, 20,606 acres; in wheat, 68 acres; in oats, 5,614 acres; in rye, 54 acres.

Cotton production: 4,870 bales; average cotton product per acre, 0.17 bale, 243 pounds seed-cotton, or 81 pounds cotton lint.

Baker county is well timbered, and drains into Flint river, its eastern border, and is almost entirely covered with wire-grass. The entire county is underlaid by a white limestone (Tertiary), which outcrops in a number of places. Buhr-stone or siliceous shell-rock overlies it, and is found in fragments on the surface. The surface of the country is very open and level, though undulating in places, and is interspersed with cypress ponds and small open lakes.

On the north, along Kiokee and Ichawaynochaway creeks, the yellow-loam region extends a short distance into the county; but the county is generally covered by the sandy soils and clayey subsoils of the lime-sink division of the wire-grass region, with much ferruginous brown gravel.

Of the area of the county 7 per cent. is irreclaimable swamps, 49 per cent. is said to have been cleared, and 30.7 per cent is under tillage, chiefly in cotton, which averages 84.3 acres per square mile, a number exceeded by but thirty-seven counties of the state. Its average product per acre is, on the contrary, extremely low, and is, with that of Glynn county, the lowest in the state.

Cotton is shipped either by boat to Albany, Columbus, or Bainbridge, or hauled to Camilla and shipped by rail to market.

ABSTRACT FROM THE REPORT OF J. H. HAND, M. D., OF LEARY, CALHOUN COUNTY.

The lowlands of the county comprise first bottoms of the creeks and Flint river, hummocks, and cypress swamps, interspersed with lagoons. The uplands are principally pine, mixed with oak lands, with generally a gray sandy soil having a clay subsoil, red or yellow in color and mixed with sand; some of it is porous, light, and loose.

The summers of this section are long, and if the crop is planted the last of March or before the 20th of April and well cultivated a good crop may be matured by the 20th of August.

The *reddish clay lands* are best for cotton, though they comprise not more than one-tenth of the lands. The growth is oak, hickory, gum, ash, and short-leaf pine. The soil is a tenacious clay loam, 10 inches in depth, with a crawfishy subsoil, varying from red to yellow or whitish. It contains soft black gravel and rounded and angular pebbles, and is underlaid by limestone at from 10 to 40 feet. The land is early, warm, and well drained. The crops of the county are cotton, corn, oats, cane, potatoes, pease, and rice. Cotton yields on fresh lands from 400 to 800 pounds of seed-cotton per acre, or from 300 to 600 pounds after ten years' cultivation. In the latter case the lint is lighter, softer, and not so long. Cotton grows from 24 to 60 inches, is most productive at 36, and runs to weed on new land in wet summers, which tendency is restrained by deep culture, but bolling is not thereby favored. Crab-grass is most troublesome; other weeds are coffee-weed, beggar-weed, and cockleburs. One-tenth of these red lands now lies turned out.

The *gray sandy pine lands* cover three-fourths of the county. The soil is 10 inches deep, with a heavier clay subsoil, and is underlaid at from 10 to 40 feet by limestone. The land contains ferruginous gravel, is easy to till, early and late, and colder than the red land. It is best adapted to oats, corn, pease, and potatoes, though one-third is planted in cotton. The latter grows from 2 to 4 feet high, and yields from 500 to 700 pounds of seed-cotton per acre when the lands are fresh, or from 250 to 500 pounds after ten years' cultivation. About one-fourth of this land now lies turned out, and produces nearly as well as when fresh.

EARLY.

(See "Central cotton belt".)

MILLER.

Population: 3,720.—White, 2,327; colored, 1,393.

Area: 240 square miles.—Woodland, all; lime-sink (wire-grass) region, all.

Tilled lands: 23,527 acres.—Area planted in cotton, 8,980 acres; in corn, 9,229 acres; in oats, 4,188 acres; in rye, 10 acres.

Cotton production: 1,905 bales; average cotton product per acre, 0.21 bale, 303 pounds seed-cotton, or 101 pounds cotton lint.

Spring creek, flowing through the center of Miller county southward, is the principal stream. The surface of the country is very level, open, and well timbered, with an almost exclusive growth of long-leaf pine and wire-grass.

Limestone (Tertiary) underlies the county, as shown by the lime-sinks which occur frequently, and by the siliceous shell-rocks which are found in fragments and in masses over the surface. These latter rocks have less of the flinty character that belongs to those of counties northward. They disintegrate more readily, forming a fine, gritty powder, varying from white to red. But few fossil shells are found in them, their former presence being usually indicated by the cavities they have occupied, which show the surface outlines of the fossil. Large masses of these light siliceous rocks occur at Colquitt, the county-seat, both on the ridge in an old excavation for a

proposed railway and on the banks and in the bed of Spring creek. The lands of the county have generally fine sandy soils and clayey subsoils, and the roads are hard and firm. Cypress swamps are abundant, and patches of "blue-jack" oak occur frequently on the north. Of the area of the county 5 per cent. is of irreclaimable swamp and 15.3 per cent. is under cultivation, chiefly in corn and cotton, the average of the latter being 37.4 acres per square mile, about the same as in Lowndes county. The character of the lands and methods of culture are similar to that of the adjoining counties.

Cotton is hauled in wagons to Bainbridge, in Decatur county.

DECATUR.

(See "Southern oak and pine uplands".)

THOMAS.

(See "Southern oak and pine uplands".)

MITCHELL.

Population: 9,392.—White, 4,189; colored, 5,203.

Area: 500 square miles.—Woodland, all; lime-sink (wire-grass) region, all.

Tilled lands: 72,367 acres.—Area planted in cotton, 30,265 acres; in corn, 23,806 acres; in wheat, 51 acres; in oats, 8,721 acres; in rye, 17 acres.

Cotton production: 5,559 bales; average cotton product per acre, 0.18 bale 261 pounds seed-cotton, or 87 pounds cotton lint.

Mitchell county is well timbered, and is very generally level and open, its surface being interspersed with lime-sinks, cypress, and other ponds. Limestone (Tertiary) is found outcropping in a number of places. Good lime is made of this rock at a kiln 7 miles south of Camilla. Buhr-stone fragments also abound, though not as plentiful as in counties north of this.

The drainage is partly to the Flint river, the western boundary, and partly southward with the headwaters of Ocklockony river.

Eight miles east of Camilla the country becomes rolling, with a yellow ferruginous gravel in the soil. The ridges between the streams are rather abrupt on the west side, but gradually fall to the east. The marshes or low grounds have here a poor sandy land, as indicated by the dense growth of the pitcher-plant.

The county is sparsely settled. Of its area 3 per cent. is of irreclaimable swamp; but about one-third has been cleared, and 22.6 per cent. is under cultivation, chiefly in cotton. The average of this crop is 60.5 acres per square mile, and it embraces 41.8 per cent. of the tilled lands. In average product per acre the county ranks very low, and only above two counties of the state.

ABSTRACT FROM THE REPORT OF W. W. SPENCE, OF CAMILLA.

The lands of the county are much the same throughout, and comprise *level pine land*, with light sandy soil and a clay subsoil. There is some bottom land, the nature of which varies but slightly from the above. The soil of the uplands is 6 inches deep, with a red sandy clay subsoil and very little gravel; is easy to till in all seasons, and early, warm, and well drained. The crops of the county are cotton, corn, sweet potatoes, and oats. Cotton comprises half of these crops, and yields on fresh land 600 pounds in the seed per acre. On land ten years under cultivation the yield is 300 pounds. Cotton grows 3 feet high, and runs to weed in wet seasons, to avoid which it is best to select prolific seed and manure highly. Crab-grass interferes most with growing crops. None of the land lies turned out, and no washings occur on these level lands.

The Savannah, Florida, and Western railroad affords means of transportation of cotton to Savannah at about $2 50 per bale.

COLQUITT.

Population: 2,527.—White, 2,422; colored, 105.

Area: 550 square miles—Woodland, all; pine barrens (wire-grass), 8 square miles; lime-sink (wire-grass) region, 542 square miles.

Tilled lands: 13,906 acres.—Area planted in cotton, 2,958 acres; in corn, 4,375 acres; in wheat, 8 acres; in oats, 2,198 acres; in rye, 12 acres.

Cotton production: 736 bales; average cotton product per acre, 0.25 bale, 354 pounds seed-cotton, or 118 pounds cotton lint.

Colquitt county is entirely within the wire-grass region. The surface is undulating, the ridges lying usually north and south. On the lowlands and between the ridges saw-palmetto is often more abundant than wire-grass.

Moultrie, the county-seat, is located on a low sandy ridge which forms the divide between Ocklockony and Little rivers. This ridge extends 3 miles north of the village, and has an undergrowth of black-jack. On the west of Moultrie ferruginous sandstone and gravel occurs on the ridges, giving to some of the lands a reddish character. The pitcher-plant grows luxuriantly on the lowlands of this section.

The irreclaimable swamps of the county comprise 1 per cent. of its area. The country is very sparsely settled, and has an average of but 5 persons per square mile. Its tilled lands average but a little more than 25 acres per square mile, or 4 per cent. of the county area, and of these 21.3 per cent. is in cotton, whose average is 5.4 acres per square mile, or a little more than 1 acre per inhabitant. Corn has a larger acreage, its average being 8 acres per square mile.

ABSTRACT FROM THE REPORT OF J. B. NORMAN, OF MOULTRIE.

The lands of the county have *fine sandy soils*, 18 inches deep, and yellow or red subsoils. The growth of the county is pine, white oak, chincapin, sweet gum, sumac, and grape-vines. The soil contains brown pebbles, and is underlaid by clay at from 3 to 6 feet. The crops are cotton, corn, rice, sweet potatoes, field-pease, oats, chufas, etc. Cotton grows from 2 to 5 feet high, and is most productive at 3½ or 4 feet. It runs to weed on rich lands in wet seasons, and is restrained by the use of fertilizers. Fresh land yields 500 pounds of seed-cotton per acre, 1,425 pounds of which make 475 pounds of lint, rating from ordinary to middling fair. After five years' cultivation the yield is from 300 to 400 pounds. Crab-grass and cocklebur are most troublesome. Not much of the land now lies turned out, neither does it wash much.

As fast as ginned cotton is shipped to Thomasville at $2 per bale.

BROOKS.

(See "Southern oak and pine uplands".)

LOWNDES.

Population: 11,049.—White, 5,412; colored, 5,637.

Area: 470 square miles.—Woodland, all; pine barrens (wire-grass), 261 square miles; lime-sink (wire-grass) region, 209 square miles.

Tilled lands: 53,373 acres.—Area planted in cotton, 17,664 acres; in corn, 20,016 acres; in wheat, 64 acres; in oats, 9,945 acres; in rye, 32 acres.

Cotton production: 4,981 bales; average cotton product per acre, 0.28 bale, 402 pounds seed-cotton, or 134 pounds cotton lint.

The surface of Lowndes county is level, or in places undulating, and is drained by the Withlacoochee and the Allapaha rivers, respectively the west and east boundaries, and which unite with the Suwanee in Florida. The county is well timbered, and the view for great distances between the pine trees is uninterrupted by undergrowth. The country north of Valdosta, and reaching a few miles south, is interspersed with many cypress swamps and palmetto flats, while in the southern part of the county an interesting feature is a limestone region, interspersed with large lakes (filling probably huge lime sinks) upon the uplands. Of these lakes Ocean pond and Long pond are the largest. This region, which reaches into Florida on the south, is uneven in its surface, due probably more to the lime-sink and lake depressions than to erosion, for its altitude is apparently not above that of the country northward.

The fresh and clear waters of the lakes maintain a constant level, though not the same in all, that of Ocean pond being 60 feet above that of Lake pond. In two or three instances they seem to be connected by underground passages. Moss and aquatic plants abound in great profusion, often making it difficult to propel a light boat through the water. There is very little swamp land around the lakes, the sandy uplands extending nearly or quite to the water's edge, in this respect resembling the lime-sinks. A few of what were once shallow lakes have gradually become dry, their dense growth of water moss, etc., becoming changed by decay into muck. One of these dry muck ponds covers about 200 acres with a depth of from 2 to 4 feet, with a number of large logs buried in the mass. The growth of this lake region embraces a very large variety, occurring, however, only in spots on the uplands, viz, long-leaf pine (everywhere and in greatest abundance), red oak, hickory, dogwood, beech, water and white oaks, magnolia, short-leaf pine, sweet and black gum, some poplar, red bay, scrub live oak, small post oak, narrow-leaf and round-leaf white oak, persimmon, cherry, white and scrub hickory, black-jack, sassafras, black haw, "granny graybeard," "queen's delight", sumac, sweet myrtle, wild mulberry, wild plum, wahoo, and very large chincapins. From the lake region the country gradually falls eastward to the river.

On the Withlacoochee river the outcropping limestone is covered by 10 feet of siliceous claystone, with quantities of chalcedony of every form and color. Over this are 40 feet of clay and soils. The siliceous rocks are found also at Troupville, and at the water's edge are of a peculiar and apparently semi-siliceous character, easily cut, and hard on drying. The rocks on the bluff are flinty in character, with interior white concretions (siliceous Vicksburg).

The lands of the southern part of the county are of the better class of the wire-grass region, viz, the "lime-sink" division. The soils are sandy, the subsoils a yellow clay. The water of the streams, dark or often nearly black from decayed vegetation, is in strong contrast to that of the ponds or lakes.

The lands of the northern part of the county are less fertile, the soils and subsoils sandy, and belong to the wire-grass region proper. Brown or yellow ferruginous pebbles are in abundance in this section of the county, and especially on the low water-divide between the two rivers.

The bottom lands along the rivers are very wide, and are covered with a luxuriant growth of saw-palmetto. The soils are sandy and dark on the surface. Of the county area 1 per cent. is irreclaimable swamp, and 17.7 per cent. tilled land, chiefly in corn. Cotton comprises 33.1 per cent. of the tilled land, and averages 37.6 acres per square mile.

ABSTRACT FROM THE REPORT OF N. B. OUSLEY, FORMERLY OF THIS COUNTY, BUT NOW OF FORT VALLEY, HOUSTON COUNTY.

The seasons in this section are sufficiently long to insure a crop. The lands are level in some parts of the county, in others rolling. The lands are classed as follows: (1) Sandy soils and clay subsoils at from 6 to 12 inches; (2) sandy soils and clay at from 6 to 10 feet from the surface; (3) flat lowlands, not swamps. The first of these is most important, and is called "*clay land*"; comprises 55 per cent. of the area of the county, and has a growth of long-leaf pine. The subsoil is sometimes of a yellowish, sometimes reddish color. When turned up it bakes hard and is impervious to water. The land contains much black gravel, and is inclined to bog in wet and becomes hard in dry seasons, but is early and warm. The crops are cotton, corn, oats, sugar-cane, and sweet potatoes. These lands are best for oats.

JEFFERSON.

(See "Central cotton belt".)

WASHINGTON.

(See "Central cotton belt".)

LAURENS.

(See "Central cotton belt".)

MONTGOMERY.

Population: 5,381.—White, 3,510; colored, 1,871.
Area: 720 square miles.—Woodland, all; pine barrens (wire-grass), all.
Tilled lands: 29,211 acres.—Area planted in cotton, 2,356 acres; in corn, 10,231 acres; in wheat, 142 acres; in oats, 4,904 acres; in rye, 9 acres.
Cotton production: 852 bales; average cotton product per acre, 0.36 bale, 516 pounds seed-cotton, or 172 pounds cotton lint.

Montgomery county is divided by the Oconee river, which flows southward and unites with the Ocmulgee on the boundary-line, forming the Altamaha river. The surface of the country is rolling on the north and more level southward.

Along the eastern side of some of the streams are low banks or ridges of white sand deposits from one-half to a mile wide, having a low growth of scrub oak and little or no grass, entirely unproductive. They have an elevation of about 50 feet above the streams. Over a large portion of the county the lands are a dark sand loam with yellow sandy subsoil, quite compact. Saw-palmetto is prominent on the lowlands. In some places the subsoil is a clay, but this is rather an exception.

The uplands, covered with the yellow ferruginous gravel or pebbles peculiar to southern Georgia, are said to be the most productive. Two per cent. of the upland area is too broken for successful cultivation.

The bottom lands on the Oconee river are wide and densely covered with a growth of hickory, maple, poplar, cypress, etc. The trees are draped with the long, hanging moss (*Tillandsia usneoids*). These lands are subject to overflow, and are not much under cultivation. The soil is a deep black sandy loam, rather marshy. From these bottoms there is a rise of 15 or 20 feet to the uplands. The irreclaimable swamp lands comprise 4 per cent. of the county area.

The country is sparsely settled (an average of seven persons per square mile), and the country people devote their attention largely to the cutting and shipment of pine lumber down the Oconee and Altamaha rivers to Darien, where it is sold for European markets. The turpentine industry is also largely followed.

Lands under tillage embrace 6.3 per cent. of the county area, and are very largely devoted to corn. Cotton acreage forms but 8.1 per cent. of the whole, and averages 3.3 acres per square mile.

ABSTRACT FROM THE REPORT OF E. M'RAE, OF MOUNT VERNON.

The most productive lands of the county are the stiff river swamps, but the larger portion of them is subject to overflow. Cotton grows very well on the *pebbly uplands*, but not on the light sandy and pine lands. The growth of the level uplands is invariably long-leaf pine. The crops are corn, cotton, sugar-cane, sweet potatoes, oats, and a little wheat and rye. The uplands are best adapted to oats, corn, pease, and potatoes. Cotton comprises only one-eighth of the crops planted. The most productive height of the cotton stalk is 2½ and 3 feet. It runs to weed in excessively wet weather unless topped in the month of August. The yield is generally from 700 to 800 pounds per acre on fresh lands and 200 after ten years' cultivation. From old lands 1,545 pounds are required for a bale of 475 pounds, the staple becoming inferior. One-tenth of the land now lies turned out, and the greater portion is growing up in old-field pine. When again taken in, this land produces well for several years. The lands do not gully or wash much. Crab-grass is most troublesome. Cotton has not been cultivated in this county to any extent heretofore because of other industries, such as stock-raising and lumbering. It is now on the increase, and under the present system of culture, with favorable seasons, is found to be profitable.

Shipments are made, from December to March, generally to Savannah, at $2 per bale.

EMANUEL.

Population: 9,759.—White, 6,660; colored, 3,099.
Area: 1,040 square miles.—Woodland, all; pine barrens (wire-grass), all.
Tilled lands: 46,439 acres.—Area planted in cotton, 10,749 acres; in corn, 24,300 acres; in wheat, 950 acres; in oats, 3,957 acres; in rye, 33 acres.
Cotton production: 3,669 bales; average cotton product per acre, 0.34 bale, 486 pounds seed-cotton, or 162 pounds cotton lint.

Emanuel, one of the large counties of the wire-grass region, is rolling and open, the growth of the uplands being almost exclusively long-leaf pine. Swainsboro', the county-seat of Emanuel county, is on a low divide between the tributaries of the Ogeechee and Ohoopee rivers. In the western and southern portions of the county the lands are underlaid by a sandstone outcropping from 5 to 8 miles west of Swainsboro' in a bluff from 18 to 25 feet, and continuous for some distance. There is a large deposit of pebbles near this place. A few miles south of this town there is an area of one-quarter of a square mile covered by a non-fossiliferous siliceous rock, which, by decomposition, yields a soft white porous mass. The siliceous rocks are also found in other places in the northern part of the county.

The soils are sandy and dark from decayed vegetation; the subsoil is usually a yellow sand. Four per cent. of the county area is irreclaimable swamp, and but little of the lowlands is under cultivation. The county is thinly settled (nine persons per square mile), and but 7 per cent. of the area is under tillage. The lumber and turpentine industry receives largely the attention of the people. By the introduction of commercial fertilizers into the county the acreage, as well as the yield of cotton, has been largely increased in the last few years.

The acreage of corn is more than double that of cotton, the latter having an average of but 10.3 acres per square mile.

ABSTRACT FROM THE REPORT OF E. H. EDENFIELD, OF SWAINSBORO'.

The *uplands* only are devoted to cotton, 40 per cent. being planted in that crop. The land is rolling enough to be well drained, the climate is mild, and the summers are long, allowing the crop to mature before frost. The growth of the uplands is only pine, the soil a dark gray, coarse, sandy loam from 6 to 10 inches deep, and the subsoil a yellow sand from 6 inches to 3 feet deep, underlaid by clay, then sand-rock at from 10 to 40 feet. The lands are early, warm, and well drained, and easy to till in all seasons, producing corn, cotton, and oats; in fact, all crops, but are best adapted to those mentioned. Cotton grows from 2½ to 3 feet high, and yields on fresh lands 500 pounds of seed-cotton per acre. Cultivation of five years reduces the yield to 300 pounds, and 1,485 pounds are then required for 475 pounds of lint. The staple is inferior on old fields. May-apple and poverty-weeds are most troublesome. Not more than one acre in twenty now lies turned out. The land produces well, and even better than at first when again cultivated. No damage is done by washing.

Shipments are made, from September to January, by the Central railroad to Savannah, at 40 cents per 100 pounds.

BULLOCH.

Population: 8,053.—White, 5,797; colored, 2,256.

Area: 900 square miles.—Woodland, all; lime-sink (wire-grass) region, 21 square miles; pine barrens (wire-grass), 879 square miles.

Tilled lands: 35,626 acres.—Area planted in cotton, 9,140 acres; in corn, 15,394 acres; in wheat, 15 acres; in oats, 7,661 acres; in rice, 852 acres.

Cotton production: 3,724 bales; average cotton product per acre, 0.41 bale, 582 pounds seed-cotton, or 194 pounds cotton lint.

Bulloch county, lying between the Ogeechee and Canoochee rivers, has an undulating surface, broken and rolling in places, and lying wholly in the wire-grass and long-leaf pine region. The northern portion of the county is embraced in the "lime-sink" subdivision, the underlying limestone making the lands superior to those in the southern part. Lime-sinks are of frequent occurrence in this section. One known as the "watering hole", 5 miles northwest of Statesboro', the county-seat, is full of water to within 5 feet of the top and "has no bottom". Limestone and white marl occurs on the Emanuel county-line, and might be profitably used on these sandy lands. Siliceous shell-rock, or buhr-stone, is found in many places.

In this lime-sink section the prevailing growth of long-leaf pine is interspersed in places with oak and hickory.

The soils of the county are very generally dark and sandy, with some clay subsoils in the northern sections. The clays are, however, generally several feet below the surface. The lands of the lower portion of the county are very level, and the growth of long-leaf pine very open.

The bottom lands, where not subject to overflow, afford excellent farming lands. Gallberry bushes, cypress, and a low swamp growth occurs on the smaller streams. Six per cent. of the area of the county is irreclaimable swamp. Of land suitable for tillage, 21 per cent. is said to have been cleared.

The county is sparsely settled, with an average of 9 persons per square mile, while 6.2 per cent. only of the area is under tillage. Corn has by far the greatest acreage, that of cotton averaging 10.2 acres per square mile. Its product per acre is far above that of the other counties of the southern part of the state.

ABSTRACT FROM THE REPORT OF J. F. BROWN, OF OGEECHEE.

Most of the lands of the county are level, but occasionally in some sections they are hilly and broken.

The *dark or black alluvial soils* comprise one-fourth of the lands of the county, and have a depth of 12 inches and a heavier yellow subsoil. The land is easily tilled in all seasons, is early, warm, and well drained, and produces cotton, corn, rice, potatoes, and oats. Cotton comprises one-third of the crops planted, grows 3 feet high, runs to weed on new land, bolling being favored by high fertilization. The yield in seed-cotton on unfertilized fresh land is 400 pounds per acre; on land four years under cultivation, 250 pounds. In both cases 1,544 pounds are required for a 475-pound bale of lint, and the staple rates as good middling. Crab-grass is most troublesome during cultivation. One-fourth of the land now lies turned out, but it produces well when again taken in. It does not wash or gully.

The *sandy second bottom lands*, comprising but a small proportion of the area, extend up and down the Ogeechee river, and have a growth of oak, hickory, and cypress. The soil is fine, sandy, and gray, and is 2 feet deep; the subsoil is lighter, underlaid by sand and gravel at several feet. The land is early, warm, and well drained, easy to till in all seasons, and best adapted to corn and grain, only one-tenth being planted in cotton. Cotton grows from 4 to 5 feet high, but yields only 200 pounds of seed-cotton per acre when fresh, or 250 pounds after four years' cultivation. In the latter case the staple is inferior. The greater part of these lands once in cultivation now lies out, but produces well when again taken in.

The *gray sandy land*, covering one-third of the county, has a growth of pine and post oak, is a fine sandy, gravelly soil 6 inches deep, and has a lighter subsoil. It contains red gravel, is easy to till, early, warm, and well drained, and adapted to the general crops. One-third is planted in cotton, which grows 3 feet high and yields 300 pounds of seed-cotton per acre both on fresh land and after four years' cultivation.

Cotton, as fast as it is ginned and packed, is shipped by the Central railroad to Savannah, at 30 cents per 100 pounds.

EFFINGHAM.

Population: 5,979.—White, 3,228; colored, 2,751.

Area: 420 square miles.—Woodland, all; savanna, 76 square miles; pine barrens (wire-grass), 292 square miles; lime-sink (wire-grass) region, 52 square miles.

Tilled lands: 22,747 acres.—Area planted in cotton, 1,767 acres; in corn, 9,337 acres; in rice, 1,970 acres; in oats, 2,096 acres; in rye, 11 acres.

Cotton production: 686 bales; average cotton product per acre, 0.39 bale, 552 pounds seed-cotton, or 184 pounds cotton lint.

Effingham county lies between the Savannah and the Ogeechee rivers, the dividing ridge being very near the latter, and is well timbered with long-leaf pine, the surface of the country being quite level and open. Along the Savannah river, in the upper part of the county, there is a low ridge, the soil of which is dark gray with a clay subsoil, on which the pine is associated with a black-jack undergrowth. This belt extends to Sister's Ferry, from which place northward along the river white limestone and marls outcrop similar in many respects to that of the counties on the north. From the ferry southward along the river, and southwest to the corner of the county, are the pine flats of the coast region, with bay and cypress swamps interspersed through the open level lands.

The sandy wire-grass lands extend from Springfield west to the Ogeechee and east to within 1 mile of the Savannah, the growth of which is very open, the country quite level, and the soil sandy, with a yellow sandy subsoil. On the northwest are the better class of wire-grass lands, with thin clay subsoils and underlying limestone.

Ten per cent. of the area of the county is irreclaimable swamp, and but 8.5 per cent. is under tillage, chiefly in corn. Cotton has an average of but 4.2 acres per square mile. The marls of the upper part of the county show the following composition: Carbonate of lime, 28.4; phosphoric acid, 0.075 per cent.

Lumbering is a prominent industry, as the rivers furnish easy transportation to the coast by rafts or by steamboats.

ABSTRACT FROM THE REPORT OF O. E. SMITH, OF EGYPT.

The lands of the county are classed as sandy and hummocks. The latter are found near the rivers, and have a growth of red oak, hickory, and walnut.

The *sandy lands*, interspersed with gallberry flats and gum ponds, cover nine-tenths of the county, and have a growth of long-leaf pine and black-jack. The soil is coarse sandy, 4 inches deep, with a yellowish sandy subsoil, somewhat clayey. It is easy to cultivate, early, warm, but ill drained, and is best adapted to corn, oats, and potatoes. The crops of the county are, in addition to these, cotton, upland rice, and West India sugar-cane. Cotton comprises one-tenth of the crops, grows 3½ feet high, runs to weed in very wet seasons, which is prevented by better drainage, and yields 600 pounds of seed-cotton per acre on fresh land, 1,485 pounds of which make 475 pounds of lint and rates as middling. Land ten years under cultivation yields 300 pounds of seed-cotton per acre. The lint is then not so good, and 1,840 pounds of seed-cotton are required for 475 pounds of lint. Crab-grass is most troublesome. One-eighth of the land now lies turned out, and after a rest produces well for a few years. The lands wash readily, but no damage is done.

Shipments of cotton are made every week during the picking season by steamboat to Savannah at 75 cents per bale.

TATTNALL.

Population: 6,988.—White, 5,014; colored, 1,974.

Area: 1,100 square miles.—Woodland, all; pine barrens (wire-grass), all.

Tilled lands: 23,166 acres.—Area planted in cotton, 2,618 acres; in corn, 10,991 acres; in wheat, 8 acres; in oats, 4,802 acres; in rice, 376 acres; in rye, 19 acres.

Cotton production: 964 bales; average cotton product per acre, 0.37 bale, 525 pounds seed cotton, or 175 pounds cotton lint.

Tattnall county, lying between the Canoochee and Altamaha rivers, is divided diagonally by the Great Ohoopee river, flowing south into the latter river. The county is entirely within the long-leaf pine and wire-grass region, and the surface of the country is quite level on the south, but rolling on the north and middle, Reidsville, the county-seat, being situated on a high sandy hill.

The county is rather sparsely settled (6 persons per square mile), and the people are not apparently much devoted to agriculture, as only 3.3 per cent. of its area is under tillage, averaging 3.3 acres per person. Corn and oats are the chief crops, the acreage of cotton being 11.3 per cent. of the tilled lands, and averaging but 2.4 acres per square mile.

Lumber and turpentine industries chiefly occupy the attention of the people, the rivers affording transportation to the Atlantic coast markets by rafts and by steamboats.

The bottom lands have sandy soils of a deep black color on the surface, from decayed vegetation. In many places this muck is quite thick.

B. H. Clifton, of Perry's Mills, says of these uplands:

Fresh wire-grass land will yield about 200 pounds of seed-cotton per acre without fertilizers, and after a few years' cultivation will average 10 bushels of corn per acre and about 200 bushels of potatoes.

John Hughey, of Reidsville:

This is a pine woods county. The land is sandy and dark, with yellow sand subsoil, and is best adapted to sea-island cotton. Cotton comprises one-third of the crops, and yields 600 pounds of seed-cotton the first and second years after clearing. Shipments are made by wagon to the nearest railroad station, or by boat down the Altamaha river.

BRYAN.

(See "Coast region".)

LIBERTY.

(See "Coast region".)

McINTOSH.

(See "Coast region".)

WAYNE.

Population: 5,980.—White, 4,060; colored, 1,920.

Area: 740 square miles.—Woodland, all; pine barrens (wire-grass), 239 square miles; pine flats, 501 square miles.

Tilled lands: 8,766 acres.—Area planted in cotton, 331 acres; in corn, 4,243 acres; in oats, 2,188 acres.

Cotton production: 119 bales; average cotton product per acre, 0.36 bale, 513 pounds seed-cotton, or 171 pounds cotton lint.

The county of Wayne, lying between the Altamaha and Little Satilla rivers, is mostly within the savanna and pine-flat region, which extends as far north as the Savannah and Gulf railroad. The country is flat and interspersed with many bay and cypress swamps (saw-palmetto flats), the better part having sandy lands and an open long-leaf pine growth. North of the railroad the country is higher and more rolling and the lands are better, having a sandy clay subsoil. The county is sparsely settled, with an average of 8 persons per square mile.

Ten per cent. of the area of the county is too swampy for successful tillage. But 1.9 per cent. of the area is under tillage, chiefly in corn, oats, and wheat. The acreage of cotton is small, averaging but 0.4 acres per square mile. Lumbering is one of the chief industries.

G. W. Stansell, of Jessup, thus describes the county:

> The lands of the northern part are rolling and sandy, with clay subsoils, and produce good crops. Cotton is raised almost entirely along Big and Little Goose creeks, and fertilizers are largely used. The short upland staple alone is cultivated in this section. Other crops along these creeks and Satilla river do equally well under good management, 8½ barrels of sugar being the reported product from half an acre, the work of one man. Fruits do well on these uplands. The flat country south of the railroad is suitable only for rice, sugar-cane, and sea-island cotton, of which little is raised.

ABSTRACT FROM THE REPORT OF JAMES W. HARPER, OF GARDI.

> The *light sandy lands* of this part of the county have a growth of yellow pine, oak, hickory, and cypress. The soil is 8 or 10 inches deep, with a yellow clay subsoil, which becomes like the surface soil when cultivated, and contains soft gravel and sometimes large pebbles. The crops are corn, oats, sweet potatoes, sugar-cane, and cotton. The land is early when well drained, and produces 800 pounds of seed-cotton per acre when fresh and 400 pounds after four years' cultivation. Cotton comprises one-fourth of the crops, grows from 3 to 4 feet high, and is troubled most with "red-top" weeds. Fifteen hundred and forty-five pounds of seed-cotton make 475 pounds of lint. On rolling lands the soil washes readily, but no serious damage is done.
>
> Cotton is shipped by railroad in November to Savannah at $1 50 per bale.

APPLING.

Population: 5,276.—White, 4,084; colored, 1,192.

Area: 1,080 square miles.—Woodland, all; pine barrens (wire-grass), all.

Tilled lands: 13,172 acres.—Area planted in cotton, 1,069 acres; in corn, 6,816 acres; in oats, 4,097 acres; in rye, 8 acres.

Cotton production: 379 bales; average cotton product per acre, 0.35 bale, 501 pounds seed-cotton, or 167 pounds cotton lint.

A low ridge or water-divide, entering Appling county from the west, separates the tributaries of the Altamaha on the north from those of the Satilla river on the south.

Appling is included in the long-leaf pine and wire-grass region proper, with its characteristic poor sandy lands, soil and subsoil. Clay sometimes is found comprising the latter, and yellow or brown ferruginous pebbles are also abundant on the surface in some localities.

The surface of the country is rather rolling and very open, the undergrowth being chiefly along the low marshy places and on streams. The county is but sparsely settled (5 persons per square mile), and the people give their attention largely to the cutting and shipment of lumber down the Altamaha river and to the production of turpentine and resin from the yellow pine timber.

But 1.9 per cent. of the county area is under cultivation, mostly in corn and oats. Six per cent. is said to be too swampy for tillage. The average of cotton is but one acre per square mile, or 8.1 per cent. of the tilled area.

J. J. Carter reports that cotton is produced chiefly in the southern portion of the county, where the land is rolling and somewhat clayey.

ABSTRACT FROM THE REPORT OF BENJAMIN MILIKIN, OF HOLMESVILLE.

The only lands devoted to cotton in this county are the *gray sandy uplands*, which are light, friable, early, warm, well drained, and easily worked, and cover the entire county, except in creeks and branches. Yellow long-leaf pine is the exclusive growth. The soil is from 4 to 6 inches deep, has a yellow sandy subsoil, slightly mixed with clay, and contains sometimes red and rough clay-like pebbles.

The crops of the county are cotton, corn, oats, sweet potatoes, sugar-cane, pease, rice, melons, and all kinds of vegetables and fruits. The sea-island or black-seed variety of cotton, which sells for two or three times as much as the short staple green-seed or upland variety, succeeds admirably. The sea breezes and salt dews are supposed to aid in its growth. The short staple does well also, producing about 600 pounds of seed-cotton per acre on fresh land and 400 pounds after three years' cultivation, the lint rating as middling and good middling. The short staple grows 3½ feet high, the sea-island 4½ feet. The stalk runs to weed in wet seasons and when too highly fertilized. This is prevented by applying a moderate amount of manure, and also by topping. The staple from either new or old lands rates equally well. The most troublesome weeds are crab-grass and a small sprangled poor-land weed.

One-tenth of the land originally under cultivation now lies out, and when again taken in does as well for the first three years as when new. The slopes of the uplands are damaged by washing, and the valleys are also sometimes injured by the deposit of sand, though in most cases the fresh material adds to the fertility of the valley lands. No effort is made to check the damage.

Shipments are made by railroad in February and March to Savannah, the freight being 40 cents per 100 pounds.

COFFEE.

Population: 5,070.—White, 4,028; colored, 1,042.

Area: 980 square miles.—Woodland, all; pine barrens (wire-grass), all.

Tilled lands: 17,618 acres.—Area planted in cotton, 1,825 acres; in corn, 6,925 acres; in oats, 5,450 acres; in rye, 5 acres; in rice, 525 acres.

Cotton production: 591 bales; average cotton product per acre, 0.32 bale, 462 pounds seed-cotton, or 154 pounds cotton lint.

Coffee county lies within the southern wire-grass region. Its surface is undulating, slightly rolling in places, on the north of the Brunswick and Albany railroad, while in general long-leaf pine is the exclusive timber, without undergrowth, the country presenting an open character.

The soil is a gray sandy loam with much ferruginous gravel, not easily washed away, and forms firm and level roads. The lowlands have a dense undergrowth of cypress and small undergrowth, are usually marshy and almost impenetrable, and the water black and mucky. The soil is covered often with a good muck, but otherwise it is white, sandy, and worthless.

On the south of the railroad the country is very level and more marshy, and saw-palmetto is abundant, mixed with sedge-grass in places. A blue clay is found at 9 feet, but above this there is little else than sand.

Sandstone seems to underlie the upper portion of the county, an outcrop 4 feet in thickness being exposed on the river bank near the railroad crossing of the Satilla river. Twenty-five per cent. of the county area is said to be irreclaimable swamp.

The county is sparsely settled, and has an average of only 5 persons per square mile. The tilled lands comprise but 2.8 per cent. of the area, and are devoted mostly to corn and oats. Cotton acreage is small, averaging but 1.9 acres per square mile. The people devote much attention to lumbering and turpentine making. The Ocmulgee and the Altamaha rivers on the north furnish easy passage for large rafts to Darien, while the Albany and Brunswick railroad carries large amounts of sawed pine lumber from the many mills along its route.

A. M. Fraser, of Hazlehurst, writes:

Most of the cotton of the county is produced in the southwest portion, where the lands are naturally more productive. In the upper part, bordering on the Ocmulgee river, the land is hilly and poor, and is best adapted to orchards and vineyards and to cattle and sheep raising. In the swamps of the river, where alluvial deposits are made to a considerable depth, corn yields from 30 to 40 bushels per acre.

ABSTRACT FROM THE REPORT OF TIMOTHY FUSSELL, OF KIRKLAND.

The upland soil does not vary much from one ridge to another, being in ridges and hills of from 1 acre to 100 acres each. On the lowlands cotton is liable to go too much to weed, and the climate being warm, it is also apt to shed badly; hence the uplands are preferred when the land is fair.

The best soils are the *clay lands* of the hills, which lie in patches and large bodies, but comprise a very small per cent. of the lands of the county. The growth is oak and yellow long-leaf pine. The depth of the soil is 2 feet, with a heavy buff subsoil, sometimes hard and rocky and quite impervious. Red sandstone underlies this at from 10 to 20 feet. The soil is easily tilled, producing corn and cotton. The lowlands are best for corn and the uplands for cotton. Cotton comprises one-third of the crops, and grows to a height of 3 feet, producing with fertilizers from 800 to 1,000 pounds of seed-cotton per acre, but after seven years' cultivation only 700 pounds under good circumstances, rating as good ordinary. Cotton from fresh land rates as middling; 1,544 pounds from old lands make 475 pounds of lint. Crab-grass gives the most trouble. One-half of these lands formerly under cultivation now lies out only because of lack of laborers. Rest improves it very much. These clay lands wash readily, doing serious damage in wet seasons, but improving the valleys.

The *open pine woods* have a sandy soil about 9 inches deep, and but little in cultivation, cotton comprising one-tenth of the crops, and producing from 400 to 500 pounds of seed-cotton per acre when fresh, but only 400 pounds the second year. One-half of these cultivated lands now lies out. The staple from old land is not as good as from fresh. Crab-grass is the most troublesome.

Cotton shipment is governed by the market. Transportation is by the Albany and Brunswick railroad to Savannah at $4 per bale.

TELFAIR.

Population: 4,828.—White, 2,666; colored, 2,162.

Area: 420 square miles.—Woodland, all; lime-sink (wire-grass) region, 12 square miles; pine barrens (wire-grass), 408 square miles.

Tilled lands: 14,124 acres.—Area planted in cotton, 2,228 acres; in corn, 6,302 acres; in oats, 2,032 acres.

Cotton production: 740 bales; average cotton product per acre, 0.33 bale, 474 pounds seed-cotton, or 158 pounds cotton lint.

Telfair county, lying between the Little Ocmulgee and Ocmulgee rivers, the latter forming the southern boundary, has a somewhat rolling surface, and is covered with an open and exclusive growth of long-leaf pine and wire-grass, except in some localities, where oak and hickory occurs. A large proportion of the uplands has a stiff, sandy soil with an abundance of rounded ferruginous pebbles, forming a better class than the sandy lands with their thin sandy subsoils. Hills of white sand frequently occur, covered only with an undergrowth of scrubby black-jack, devoid of wire-grass and unproductive.

Specimens of soil and subsoil were selected from this county for analysis as typical of the lands of the wire-grass region proper (see page 50). The yield from fresh lands is given by many practical farmers in the county at 500 pounds of seed-cotton per acre; others claim more. The lands, however, are not durable.

The irreclaimable swamp lands, with their heavy growth of timber, comprise 8 per cent. of the county area, and their soils, a black and mucky sand or loam, are deep. The waters of the small streams are also very dark from decayed vegetation.

Only about 17 per cent. of the lands of the county have been cleared, the country being rather sparsely settled (11 persons per square mile), and the lumber industry occupying a large share of the attention of the people, as in other counties of this region. The Ocmulgee and Altamaha rivers furnish easy transportation to the Atlantic coast for rafts, while river steamboats and the Macon and Brunswick railroad carry sawed lumber and other products to Macon, Brunswick, and other markets.

But 5.3 per cent. of its area is under tillage, chiefly in corn, cotton, and oats. Cotton averages 5.3 acres per square mile.

ABSTRACT FROM THE REPORT OF I. F. M'RAE, OF LUMBER CITY.

The *sandy lands* occupy two-thirds of the county and have a growth of pine timber. The soil is 3 inches deep, with a subsoil varying from stiff to rocky and sandy. The crops of the county are corn, sugar-cane, sweet potatoes, cotton, and oats. Cotton comprises one-fourth of the crops, grows 3 feet high, and runs to weed on fresh, moist land and with heavy fertilizing unless prevented by topping. The yield on fresh land is 900 pounds of seed-cotton per acre, or 500 pounds after five years' cultivation, 1,544 pounds from old lands making 475 pounds of lint rating from low to good middling. Hog-weeds are most troublesome. One-half of the land lies turned out. These lands yield as well as when fresh when again taken into cultivation, and wash readily, but no serious damage is done.

The *pine, oak, and hickory lands* yield about 1,200 pounds of seed-cotton, making 400 pounds of lint, and rating as low middling in market. Cotton comprises one-third of the crops planted on these lands. Hog-weeds are most troublesome. One-half the lands now lies out, increasing in productiveness in proportion to the length of time lying out.

Cotton is shipped, between October and January, by railroad to Savannah at 31 cents per 100 pounds.

DODGE.

(See "Wire-grass and lime-sink region".)

WILCOX.

Population: 3,109.—White, 2,411; colored, 698.

Area: 500 square miles.—Woodland, all; pine barrens (wire-grass), 110 square miles; lime-sink (wire-grass) region, 390 square miles.

Tilled lands: 18,229 acres.—Area planted in cotton, 5,278 acres; in corn, 7,804 acres; in wheat, 6 acres; in oats, 3,086 acres.

Cotton production: 1,331 bales; average cotton product per acre, 0.25 bale, 360 pounds seed-cotton, or 120 pounds cotton lint.

Wilcox county, lying along the west side of the Ocmulgee river, is situated on the Atlantic and Gulf water-divide, the low ridge entering from Dooly on the northwest and passing southward into Irwin county. The Gulf tributaries (the headwaters of the Allapaha river) flow in a southerly course, while the small streams emptying into the Ocmulgee flow eastward. The surface of the country is on the north and middle rather rolling, but quite level on the south.

The best lands are found along the streams and on their immediately adjoining uplands, their subsoil being generally a clay under sandy soils of varying depths. Shell marls, with siliceous strata overlying, are found outcropping in the river bluff 4 miles southeast of Abbeville, the county-seat, and a few lime-sinks occur on the southwest of the village on the lowlands. The growth is largely interspersed with post oak and black-jack. All the uplands away from the streams are sandy, with ferruginous gravel, and have a yellowish sandy subsoil, though underlaid by clays. Their growth is long-leaf pine and wire-grass, with some scrubby black-jack. These lands cover the largest part of the area of the county.

Two and one-half per cent. of the county is said to be too broken for cultivation, and 8 per cent. to be of irreclaimable swamp. The county is thinly settled (6 persons per square mile), and but about 5.7 per cent. of its area is under tillage. The lumber industry occupies a large share of the attention of the population, the Ocmulgee river affording easy transportation for rafts.

Corn and cotton are the chief crops, the latter having an average of 10.6 acres per square mile and a lower product per acre than other county of the region.

ABSTRACT FROM THE REPORT OF S. D. FULLER, OF HOUSE CREEK.

The lands of the county may be classed as ash-colored hummocks, lying mostly on rivers and creeks, and having a clay subsoil; dark gray soils on creeks, and having red-clay subsoils; light sandy soils with iron-ore pebbles on the inland uplands.

The *hummocks* comprise one-tenth of the lands, and occur along very nearly the whole length of all the rivers and creeks. The growth is pine, with some oak. In the swamps themselves oak, hickory, ash, and other valuable timber are found. The soil of these hummocks is a dark fine sandy loam, or what might be termed a mixed soil, 12 inches deep, with a subsoil of stiff red or yellow clay with pebbles, becoming soft after being plowed up and mixed with the top soil. The lands are early and warm when well drained, and well adapted to cotton, corn, cane, and potatoes. Cotton comprises one-third of the crops, grows to a height of 4 feet, and yields about 800 pounds of seed-cotton per acre on fresh land. It also runs to weed on fresh lands, but the use of superphosphates checks it. This land yields from 300 to 500 pounds per acre after ten years' cultivation, and is troubled mostly with hog-weeds. Lint from fresh lands rates as middling; that from old, low middling; in each case 1,425 pounds of seed-cotton are required for 475 pounds of lint. Very little of this land now lies out, as it produces as well after resting as at first. Very little damage is done by washing.

The *dark gray gravelly and sandy soils* along the creeks cover one-fourth of the area of the county, and have a growth of pine, with some oak and black-jack. The soil has a depth of 15 inches, contains pebbles, and has an impervious yellow-clay subsoil that becomes soft after being plowed up. This land is early and warm when well drained, and well adapted to all the crops. One-third is planted in cotton, which grows to a height of 4 feet, yielding 600 pounds of seed-cotton per acre on fresh land and 500 after ten years' cultivation.

The *light sandy, pebbly soil* covers a large proportion of the county, has a growth of pine and scrub black-jack, and lies mostly off from the rivers and creeks. Its depth is 5 inches, with a light yellow sandy and pebbly clay subsoil underneath. It is also early and warm, and well adapted to all crops. Cotton grows to a height of 2 feet, yielding 400 pounds of seed-cotton per acre on fresh land; also after ten years if the land has been rested, 1,900 pounds being required for 475 pounds of lint. The land produces well after a rest, and does not wash.

Cotton is shipped, from September to January, by steamboat to Savannah at $2 per bale.

IRWIN.

Population: 2,696.—White, 2,161; colored, 535.

Area: 680 square miles.—Woodland, all; lime-sink (wire-grass) region, 71 square miles; pine barrens (wire-grass), 609 square miles.

Tilled lands: 11,658 acres.—Area planted in cotton, 1,800 acres; in corn, 4,049 acres; in oats, 3,319 acres.

Cotton production: 595 bales; average cotton product per acre, 0.33 bale, 471 pounds seed-cotton, or 157 pounds cotton lint.

Irwin county is included in the wire-grass region. The surface is broken or slightly rolling on the north and east, but falls and is more level southward. Long-leaf pine is the almost exclusive growth, between whose tall and bare trunks long views may be obtained, broken only by the undergrowth of cypress ponds or small streams.

On the east, along the Ocmulgee river, there are some good lands, but over the county generally the soils and subsoils are sandy and unproductive after a few years' cultivation.

Sandstone underlies the lands near Irwinville, and ferruginous gravel is abundant in many places, giving rise to a better class of soil.

About 15 per cent. of the area is irreclaimable swamp. The county is sparsely populated (4 persons per square mile). Much attention is given to cattle and sheep.

Only about 2.7 per cent. of the area of the county is under cultivation, and of that 15.4 is devoted to cotton, commercial fertilizers being advantageously used in its culture.

The lands are similar in character, and the methods of culture the same as in Coffee and Telfair and other adjoining counties. The Brunswick and Albany railroad affords transportation facilities to the southern part of the county, while on the east boats ply between Macon and Darien on the Ocmulgee, which also bears down rafts of lumber to the coast.

BERRIEN.

Population: 6,619.—White, 5,783; colored, 836.

Area: 760 square miles.—Woodland, all; lime-sink (wire-grass) region, 96 square miles; pine barrens (wire-grass), 664 square miles.

Tilled lands: 26,214 acres.—Area planted in cotton, 5,583 acres; in corn, 8,429 acres; in wheat, 15 acres; in oats, 8,199 acres; in rice, 398 acres.

Cotton production: 2,008 bales; average cotton product per acre, 0.36 bale, 513 pounds seed-cotton, or 171 pounds cotton lint.

Berrien county, lying between the Allapaha and Little rivers, is covered by an open growth of long-leaf pine and wire-grass. The surface of the county on the north of Nashville is rolling, the soils containing a black or brown ferruginous gravel. On the south the country is quite level, its flatness being broken only by the streams and the cypress marshes and ponds. A feature of this low land is the number of large areas of tall "pitcher-plants".

The waters of the small streams are slow and sluggish in motion, and, with those of the ponds, are colored black from decayed vegetation. The soil of these swamps and marshes is but little else than a white sand filled with rootlets and decayed vegetation, and sometimes covered for an inch or two with muck. These lands are considered worthless, though the muck might be profitably used on the farms. Fifteen per cent. of the area of the county is reported as being of these irreclaimable swamp lands. The growth is poplar, cypress, gum, titi, and pine, with occasionally a little oak and hickory.

But 5.4 per cent. of the county area is under tillage, and mostly in corn and oats, cotton being third, with an average of 7.3 acres per square mile. The county has a population averaging but nine persons per square mile.

ABSTRACT FROM THE REPORT OF HENRY T. PEEPLES, OF NASHVILLE.

The rolling as well as the flat lands of the county are well adapted to the culture of cotton, but are all thin. The lands are all sandy and dry very rapidly, and in some seasons there is a failure to get a stand at the proper time. They are very easily cultivated, and produce remunerative crops. Manuring and fertilizing add greatly to the production. The lands may be classed as chocolate, gravelly, or pimply, with a shallow subsoil shelving to the south; flat sooty, sandy soil, with a deep subsoil; high sandy lands, which in wet weather produce finely.

The *chocolate or pimply gravelly* lands are the best cotton lands, but they do not exceed one-twentieth of the area of the county. They occur in all the piny woods of the state. The soil is a fine sandy gray loam from 6 to 10 inches deep, underlaid by a hard, variegated clay, red, brown, chalk-like, and sticky. It contains red ferruginous gravel or concretions, and is early, warm, ill drained, and difficult to till in wet but easy in dry weather. The chief productions are cotton, corn, oats, pease, rice, potatoes, chufas, peanuts, and turnips. Cotton grows to a height of from 2 to 6 feet, is most productive at 3 or 4 feet, and runs to weed on fresh land. It produces on fresh land only from 300 to 400 pounds of seed-cotton per acre, but from 500 to 600 pounds after two years. The lint rates as low middling from fresh land, and one grade better from the second year's crop. "Dog-fennel" and "chicken-weed" are most troublesome. These lands wash but slightly.

The *sandy "sooty" land*, with its growth of long-leaf pine and wire-grass, is the second-grade cotton soil of the county, covering two-fifths of its area and extending over the southern portion of the state. It has a depth of 6 or 8 inches and a subsoil of compact clay, hard and variegated, with gravel at 2 feet. Its growth is mostly pine. It is easily cultivated, is early, warm, and ill drained, producing from 400 to 600 pounds of seed-cotton per acre when fresh and from 500 to 800 pounds after two years' cultivation. One-tenth of these lands now lies out, but they are very thrifty when again cultivated. They wash but little.

White sandy soil occurs in localities comprising one-tenth of the lands of the county, having a growth of pine, scrub oak, and black-jack. Its depth is only from 2 to 4 inches, and is underlaid by a stiff clay and gravel at from 2 to 4 feet. It produces from 200 to 400 pounds of seed-cotton per acre when fresh and from 300 to 500 pounds after four years' cultivation. One-tenth of this land lies out, and it recuperates very slowly. It washes readily, doing serious damage sometimes.

Cotton is shipped, as fast as ginned, by the Albany and Brunswick and other railroads to Savannah.

LOWNDES.

(See "Wire-grass and lime-sink region".)

WARE.

(See "Pine flats and coast region".)

PIERCE.

Population: 4,538.—White, 3,065; colored, 1,473.

Area: 540 square miles.—Woodland, all; pine barrens (wire-grass), 200 square miles; pine flats, 340 square miles.

Tilled lands: 9,496 acres.—Area planted in cotton, 994 acres; in corn, 4,105 acres; in oats, 2,209 acres.

Cotton production: 369 bales; average cotton product per acre, 0.37 bale, 528 pounds seed-cotton, or 176 pounds cotton lint.

Pierce county resembles Wayne very greatly in its topographical features as well as in the character of its lands. On the southeast the country is level and covered with cypress ponds and palmetto and gallberry flats; on the northwest it is slightly rolling or undulating, and the lands are better. The soils are sandy, contain ferruginous gravel, and have a yellowish subsoil more or less clayey. The growth of long-leaf pine is very open, with but little undergrowth, and wire-grass prevails everywhere.

Satilla, Little Satilla, and Hurricane rivers flow through the county in an east and southeast course, and lumber and turpentine industries absorb largely the attention of the people. The country is sparsely settled (8 persons per square mile), and but 2.7 per cent. of the lands are under tillage, chiefly in corn and oats. The average of cotton is 1.8 acres per square mile.

Irreclaimable swamps cover about 7½ per cent. of the county. Muck is very abundant on all the lowlands or swamps, and rests usually on a white sandy soil.

ABSTRACT FROM THE REPORT OF HENRY J SMITH, M. D., OF BLACKSHEAR.

The lands of the county are very much the same everywhere, with the exception of the ponds and branch bottoms. The soil is universally thin and sandy, but capable of any amount of improvement. Very little lowland is in cultivation, and the little that has been cleared has been abandoned as being very uncertain for cotton, making too much foliage and causing the bolls to rot. Even for corn and rice the same uncertainty exists because of a worm that attacks them. Both varieties, upland and sea-island cotton, do well in the uplands, except when attacked by rust and the caterpillar.

The lands suitable for cotton hardly exceed one-fifth of the lands of the county, and do not occur in very large bodies. The *fine sandy loam soil* is from 10 to 20 inches deep, has a yellowish sandy subsoil, often filled with brown pebbles (sand held by iron), and underlaid by an impervious clay stratum at from 1 foot to 3 feet. The crops of the county are corn, cotton, sugar-cane, pease, potatoes, oats, rice, ground-pease, and chufas. With fertilizers corn yields about 40 bushels per acre. Cotton comprises but one-fourth of the crops, yielding on fresh land possibly 300 pounds per acre in the seed, 1,665 pounds being required for 475 pounds of lint, which rates as middling. After four or five years' cultivation the yield would be almost nothing unless fertilizers were used.

Cotton grows tall and weedy on natural lands, but does not fruit well without manures. Fertilizers restrain the tendency to run to weed on new land and also favor bolling. Crab-grass alone is troublesome. Old lands are generally improved by rest after being worn out, and farmers prefer improving them than to taking in new. The lands are too level to suffer by washing and gullying. Oats are the favored of all crops on this land, the soil being too light and friable for such a tender plant as cotton, unless it could be filled with humus to absorb the sun's rays in summer and prevent its scorching reflection upon a growing and luxuriant cotton-plant. The effect of a few such days is sufficient to cause to fall every bloom and form from the plant.

The lumber and turpentine industries are much more remunerative, and the higher prices offered to laborers by those engaged in these industries make it almost impossible to secure farm hands at fair prices.

The railroads furnish means of transportation of cotton to Savannah, and shipments are made, as fast as ginned, at 40 cents per 100 pounds.

PINE FLATS AND COAST REGION.

(Embraces all or parts of the counties of Ware, Clinch, Echols, Charlton, Camden, Pierce,* Wayne,* Glynn, McIntosh, Liberty, Bryan, and Chatham.)

WARE.

Population: 4,159.—White, 3,015; colored, 1,144.

Area: 620 square miles.—Woodland, all; pine barrens (wire-grass), 151 square miles; pine flats, 469 square miles.

Tilled lands: 8,332 acres.—Area planted in cotton, 524 acres; in corn, 3,388 acres; in rice, 565 acres; in oats, 1,953 acres; in rye, 8 acres.

Cotton production: 158 bales; average cotton product per acre, 0.30 bale, 429 pounds seed-cotton, or 143 pounds cotton lint.

All of the southern portion of Ware county is included in the Okefenokee swamp (see page 51), and is almost uninhabitable. The upper portion of the county has a slightly rolling surface, a tall open growth of long-leaf pine, and a carpet of wire-grass. These approach to within a short distance of the swamp, when broad and flat areas of saw-palmetto appear, largely replacing the grass. The lands of the wire-grass region are stiff and sandy, with ferruginous gravel and sandy subsoils. Cypress swamps are interspersed throughout the area. The creeks which flow into the swamp on the north unite and form Suwanee river, which passes out on the west and turns southward.

The county is sparsely settled (7 persons per square mile), and but 2.1 per cent. of its area is under tillage, corn and oats being the chief crops. Cotton has an average of eight-tenths of an acre per square mile.

Two railroads cross at Waycross and furnish the means of transportation direct either to Savannah or to Brunswick.

CLINCH.

Population: 4,138.—White, 3,300; colored, 838.

Area: 900 square miles.—Woodland, all; pine barrens (wire-grass), 141 square miles; pine flats, 759 square miles.

Tilled lands: 14,346 acres.—Area planted in cotton, 1,622 acres; in corn, 5,524 acres; in rice, 1,268 acres; in oats, 3,359 acres.

Cotton production: 511 bales; average cotton product per acre, 0.32 bale, 450 pounds seed-cotton, or 150 pounds cotton lint.

The surface of Clinch county is very level and flat, and is covered with an open growth of long-leaf pine, saw-palmetto, and some wire-grass, interspersed with cypress ponds, gallberry flats, and small swamps of cassino, maple, titi, water oak, tupelo and black gums, and short-leaf pine. Eighteen per cent. of the area is irreclaimable swamp. The streams are black and very sluggish. Muck is abundant on the lowlands, and is several inches deep over a white sand bottom. The soils and subsoils of the county are sandy, and but 15 per cent. of the lands have been cleared.

The yellow long-leaf pine timber affords lumber of fine quality. The county has an average population of but 5 persons per square mile, and but 2.5 per cent. of its area is under tillage. Corn and oats are chief crops, the average of cotton being 1.8 acres per square mile. J. Tomlinson, of Homerville, reports that the greater part of the sea-island cotton is produced on the Allapaha river and Suwanoocha creek.

ABSTRACT FROM THE REPORT OF P. STOTESBURY, OF STOCKTON.

The surface of the country is very flat and level, and is not strictly uplands, neither is it what is known as lowlands. It is drained by creeks emptying into the Suwanee and Allapaha rivers. The higher lands are preferable for short staple and the lowlands for long staple, "black-seed" or sea-island. The lands are interspersed with ponds and gallberry flats. The growth is long-leaf pine, scrub oaks, saw-palmetto, and wire-grass. The soil is from 2 to 3 inches deep; the subsoil sandy, leachy, and yellow. The higher lands contain reddish-brown pebbles. The crops are long and short staple cotton, sugar-cane, pease, sweet and Irish potatoes, corn, oats, some wheat, rye, turnips, etc. This is the best oat-growing section, the lands being especially adapted to that crop. Cotton comprises one-fourth of the crops, grows from 3 to 5 feet high, and yields from 600 to 800 pounds of seed-cotton per acre on fresh lands. After five years' cultivation the yield is from 300 to 400 pounds. Crab-grass alone is troublesome. The lands do not wash, and but little now lies turned out.

Sea-island cotton is produced chiefly on the rivers and creeks. The average weight is 350 pounds to the bale.

Cotton is shipped by railroad to Savannah from October to January.

ECHOLS.

Population: 2,553.—White, 2,053; colored, 500.

Area: 400 square miles.—Woodland, all; pine barrens (wire-grass), 81 square miles; pine flats, 319 square miles.

Tilled lands: 15,785 acres.—Area planted in cotton, 3,578 acres; in corn, 5,159 acres; in oats, 1,650 acres; in rice, 106 acres.

Cotton production: 731 bales; average cotton product per acre, 0.20 bale, 291 pounds seed-cotton, or 97 pounds cotton lint.

Echols county is drained by the Suwanoochee and Allapaha rivers, both flowing southward. The lands along this latter river and in this section of the county belonging to the better class of the wire-grass region are underlaid by limestone, and have a growth of long-leaf pine, with some red oak and hickory. The surface of the country is very level.

On the east cypress ponds and palmetto flats become abundant, and wire-grass ceases almost entirely as Okefenokee swamp is approached. The surface is covered with a tall growth of long-leaf pine. The lands are not as fertile as on the west.

Of the area of the county, one-third is irreclaimable swamp. The population averages but six persons per square mile, and 6.2 per cent. of the county is under cultivation. These are chiefly in the western part, and are devoted to corn, cotton, and oats. Cotton has an average of 8.9 acres per square mile.

Sea-island cotton is chiefly cultivated, the bales being about 350 pounds weight. This variety is not as prolific as the short staple, and hence perhaps the low productiveness that returns show.

ABSTRACT FROM THE REPORT OF JOHN HERNDON, OF STATENVILLE.

The *gray and sandy lands* are the best in the county. The growth is pine, with some red oak and hickory. The soil is 15 inches deep, and produces corn, cotton, oats, sweet and Irish potatoes, and ground and field-pease. One-half the crops is of cotton, and chiefly of the sea-island or long-staple variety. The yield is from 800 to 1,000 pounds per acre on fresh land and from 600 to 700 pounds after three years' cultivation. The lint rates as middling upland. Short-staple upland cotton grows from 2 to 3 feet high; sea-island from 4 to 6 feet. The latter should be topped on the first of July to favor bolling. The weed most troublesome is "dog-fennel". None of this land lies out for more than one year, as even that short time greatly improves it. No damage is done by the small amount of washing to which this soil is liable.

Cotton is shipped as early as the first of November, by railroad, to Savannah at $3 per bale.

CHARLTON.

Population: 2,154.—White, 1,794; colored, 360.

Area: 1,060 square miles.—Woodland, all; all in pine flats region and Okefenokee swamp.

Tilled lands: 5,077 acres.—Area planted in cotton, 258 acres; in corn, 1,980 acres; in oats, 684 acres; in sweet potatoes, 179 acres; in rice, 47 acres.

Cotton production: 62 bales; average product per acre, 0.24 bale, 342 pounds seed-cotton, or 114 pounds lint.

A large part of Charlton county, embracing the western half, is included in Okefenokee swamp. From the eastern edge of the swamp the surface of the county rises to a low sandy ridge, about 20 feet above the swamp and about 118 above tide-water at Trader's Hill. This ridge, the Atlantic and Gulf water-divide, slopes rapidly to eastward and passes on the south into Florida. The lands are sandy, often a deep whitish sand bed, and is timbered with an open growth of long-leaf pine. The two rivers, Saint Mary's and Satilla, flowing respectively from the south and north, approaching each other to within a few miles, and, suddenly and abruptly turning to the coast, flow between high banks for the most part, Trader's Hill being located some 74 feet above tide-water. A bed of white marl is exposed in the banks of the Satilla at Burnt Fort. (For further description of the region, see page 50.) Corn and oats are the chief crops; cotton is but little planted. Lumbering, and especially turpentine-making, are the chief industries.

Shipments are made by schooner along the rivers to seaport cities.

CAMDEN.

Population: 6,183.—White, 2,091; colored, 4,092.

Area: 620 square miles.—Woodland, all; all pine flats, savannas, and live-oak and coast lands.

Tilled lands: 9,106 acres.—Area planted in cotton, 206 acres; in corn, 3,195 acres; in oats, 138 acres; in sweet potatoes, 370 acres; in rice, 2,463 acres.

Cotton production: 68 bales; average product per acre, 0.33 bale, 471 pounds seed-cotton, or 157 pounds lint.

Camden county embraces a belt of high sandy islands covered with live-oak timber, low coast marsh lands along the immediate border of the mainland, and a belt of live-oak and higher lands reaching inland to the level savannas region, the growth also fringing the streams to the foot of the Atlantic and Gulf water-shed in Charlton county. The savannas, with their level lands, interspersed with palmetto and swampy flats, cover the greater part of the county. A narrow strip of the county surface along its western border rests upon a terrace some 15 or 20 feet above the savannas. (See further description of the county in general part, page 51.) Corn, rice, and vegetables are the chief crops, cotton having an average of but three-tenths of an acre per square mile.

ABSTRACTS FROM THE REPORTS OF E. A. M'WHORTER AND JOSEPH SHEPARD, OF SAINT MARY'S.

All of the lands are level and sandy. Cotton is usually planted on the dry sandy upland, though a little is grown on reclaimed marshes. Being near the sea-coast and under the influence of the salt atmosphere, the sea-island variety alone is planted. The largest part of the county is covered with pine timber, the swamps having oak, hickory, beech, gum, cypress, etc.

The *fine silty soil* of the lowlands is devoted almost exclusively to rice; the *sandy uplands* produce cotton, potatoes, and sugar-cane. The subsoil is generally a sand, though red and yellow clays are found in places. The crops of the county are corn, rice, cotton, sweet potatoes, sugar-cane, and vegetables of all kinds. The lands produce from 10 to 15 bushels of corn per acre, and from 400 to 500 pounds of sea-island seed-cotton, or 300 pounds after four years' cultivation. Cotton grows from 4 to 10 feet high, but is most productive at from 4 to 8 feet. Running to weed is prevented by planting on rich natural land or by moderate manuring. The troublesome weeds are tea- and bitter-weed, cocklebur, Jerusalem oak, dog-fennel, and crab-grass. At least one-third of the lands now lies turned out, but produce well when again brought into cultivation. They are all too level to wash or gully.

Shipments are made in the winter by coast steamboats to Savannah.

PIERCE.

(See "Wire-grass and pine barrens region".)

WAYNE.

(See "Wire-grass and pine barrens region".)

GLYNN.

Population: 6,497.—White, 2,195; colored, 4,302.

Area: 430 square miles.—Woodland, all; all coast lands, live-oak lands, and savannas.

Tilled lands: 5,615 acres.—Area planted in cotton, 58 acres; in corn, 1,565 acres; in oats, 241 acres; in rice, 2,749 acres.

Cotton production: 10 bales; average product per acre, 0.17 bale, 246 pounds seed-cotton, or 82 pounds cotton lint.

Glynn county resembles the adjoining counties in all of its topographical and agricultural features, and their repetition is unnecessary. The county, outside of the city of Brunswick, is very sparsely populated. Corn, oats, rice, and sweet potatoes are the chief crops. There is less cotton planted here than in any other county of the state excepting the mountain counties of the extreme north. Sea-island cotton is chiefly raised; its product per acre being low.

Shipments of every kind are mostly made by ship from the city of Brunswick, which is also connected by railroad with Savannah and the interior cities.

McINTOSH.

Population: 6,241.—White, 1,546; colored, 4,695.

Area: 530 square miles.—Woodland, all; pine barrens (wire-grass), 153 square miles; pine flats, 12 square miles; savanna, 170 square miles; live-oak, marsh, and islands, 195 square miles.

Tilled lands: 8,898 acres.—Area planted in cotton, 339 acres; in corn, 2,825 acres; in rice, 4,035 acres; in oats, 354 acres.

Cotton production: 104 bales; average cotton product per acre, 0.31 bale, 438 pounds seed-cotton, or 146 pounds cotton lint.

McIntosh county in its general features resembles the adjoining county of Liberty. Along the coast the marsh and live-oak lands extend inland for several miles, while up the Altamaha river tide-water reaches 16 miles from the marshes. The tide swamp lands produce a great abundance of rice and sugar-cane.

The savanna and pine flat region covers the county westward from these marshes to the pine hills, and includes the largest part of its area. The growth of long-leaf pine is very open, as in other counties, and palmetto flats and cypress or gum ponds are also scattered throughout its area. The slightly rolling pine and wire-grass lands are found in the northwest, where the soil contains much ferruginous gravel.

Irreclaimable swamps comprise 15 per cent. of the area of the county. The soils are dark or white sands, covered with several inches of muck. The Altamaha river furnishes the means of transportation for immense quantities of timber each year from this and the counties above to Darien.

It is thought that 30 per cent. of the area of the county has been cleared, though but 2.6 per cent. is now under cultivation. Corn and oats are the chief crops. The cotton acreage is small, averaging but six-tenths of an acre per square mile. The lands are best suited to sea-island cotton. Lumbering is one of the chief industries of the county.

Darien, the county-seat, is situated 4 miles from the mouth of the Altamaha river in a large grove of live oaks. It is the chief lumber port of the South Atlantic coast, receiving its supplies by rafts floated down the river. It is not properly a cotton port, as its only means of communication with the cotton-producing counties is by the river steamboats.

William C. Wylly, of Darien, says:

There is not enough cotton made in this district to justify a report. Previous to 1865 this county had a productive interest in the sea-island cotton crop, but this has not as yet been revived, although of late there has been a growing interest and belief in the re-establishment of the old industry.

LIBERTY.

Population: 10,649.—White, 3,581; colored, 7,068.

Area: 720 square miles.—Woodland, all; pine barrens (wire-grass), 420 square miles; savanna, 166 square miles; live oak, marsh, and islands, 134 square miles.

Tilled lands: 23,047 acres.—Area planted in cotton, 2,084 acres; in corn, 8,565 acres; in rice, 4,211 acres; in oats, 3,597 acres.

Cotton production: 679 bales; average cotton product per acre, 0.33 bale, 465 pounds seed-cotton, or 155 pounds cotton lint.

Liberty county includes in its area Saint Catherine and smaller islands. Four agricultural regions are represented in the county, viz: coast marsh, live-oak lands, savannas or pine flats, and the sandy wire-grass lands.

The lands are generally level, and two of the three large divisions occupy what might be termed terraces. The marsh lands are low and but little above tide-water. The first terrace, 15 feet above these, is a level plain 15 miles wide, covered by the savannas, with their open growth of long-leaf pine and "carpet of flowers" and saw-palmetto. The live-oak lands border these savannas along the marsh and the various streams. (For description of these lands by Mr. King, and for analysis, see page 52.) Another terrace, rising quite abruptly 10 or 15 feet above this, forms a north and south line across the county, Hinesville being situated on and Walthourville below the plain. This also marks the southern limit of the wire-grass region. Its surface is more or less undulating, and the growth of long-leaf pine is very open, with very little undergrowth. Near Hinesville the terrace is covered with deep heavy sands and gravel, and is called "the gravel hills". The pine and wire-grass lands, comprising the sandy soils peculiar to the entire region, have a coarse, brown gravel, and frequently pebbles one or two ounces in weight. It is reported that the wire-grass in some places is being displaced and crowded out by a dog-fennel weed.

Of the county area 5 per cent. is under cultivation, chiefly in corn, oats, and cotton, the latter embracing 9 per cent. of the tilled lands and averaging 2.9 acres per square mile.

A report gives the sea-island cotton production in 1879 as 5 per cent. of the entire number of bales raised in the county.

ABSTRACT FROM THE REPORT OF JAMES A. M. KING, OF DORCHESTER.

The *yellow sandy soils*, from 4 to 8 inches deep, with white or yellowish sandy subsoils, are the best for cotton, being surest against rust. They comprise 1 per cent. of the lands, and extend from the Savannah to the Altamaha river and adjoining tide-water, and have a growth of live and water oaks, chincapin, hickory, pine, and cedar. The soil is compact and leachy, and is underlaid by sand for 20 feet. It is early, warm, and well drained, and is best adapted to corn as a remunerative crop. Corn, highland rice, and potatoes are the crops of the county. Cotton is planted only in small patches. Fresh lands yield 600 pounds of sea-island cotton, in the seed, per acre, and 400 pounds after six years' cultivation, the rule being to rest the land one year in three. From fresh land 1,425 pounds if ordinary and 1,780 pounds, if fine, make 475 pounds of lint, and the lint is longer and more silky than that from old, which is harsh. Sea-island cotton grows from 4 to 10 feet high, and is most productive at 6 feet, but runs to weed in wet seasons or with deep cultivation, the remedy being "wholesome neglect" or leaving it alone until as large as desired, when it must be cleaned. Weeds generally termed herbaceous plants are not troublesome. The grasses, crab, Bermuda, and nut-grass, are hard to manage in wet weather. The sea-island cotton lands are not as good as when they were abandoned at the breaking out of the war in 1861. They are too level to wash any.

The *gray, fine and coarse sandy lands*, with clay subsoils, are the second best in quality, but with too much rain, while growing, the crops suffer from rust. They are the savannas or pine flats, and comprise 50 per cent. of the area of the county. The growth is pine, water oak, cypress, gum, etc. The lands are best adapted to corn, oats, rice, and in some places to upland cotton. The cotton area is very small.

The *swamp lands above tide-water*, with their growth of cypress, water oak, gum, some ash, maple, and beech, comprise 10 per cent. of the area, have a depth of from 1 foot to 4 feet, and are best adapted to rice, and when safe from floods yield large crops of upland cotton. But little of the latter crop is planted.

The choice sea-island cotton lands are not suited to upland or short-staple cotton; therefore but little is planted. Labor is also too unreliable. I am manuring our cotton lands on the sea-coast with marsh mud, and hope to make upland cotton of the most productive kind a success in small and then in larger areas.

ABSTRACT FROM THE REPORT OF L. B. NORMAN, OF M'INTOSH.

The *fine sandy loam lands* cover two-thirds of the county, and have a growth of long-leaf pine, oak, and hickory. The soil is from 3 to 9 inches deep, with a yellow subsoil near the surface and a red clay below at from 2 to 5 feet. The crops of the county are rice, corn, potatoes, cotton, sugar-cane, pease, and oats. Cotton grows from 3 to 5 feet high, and yields on fresh lands 900 pounds of seed-cotton per acre, which makes "middling" lint. Ten years' cultivation reduces this to 200 pounds, and 1,485 pounds making 475 pounds of lint. Red-weed or horse-sorrel, brown-sedge, and crab-grass are most troublesome. The lands are much improved by lying out.

The *black swamp or hummock lands* are found in occasional strips from a quarter of a mile to 2 miles wide along the streams. They are best adapted to sea-island cotton, but very little is planted. The yield on fresh land is 1,500 pounds of seed-cotton per acre, 1,900 pounds making 475 pounds of lint. Crab-grass gives the most trouble. After five years' cultivation the yield is 1,900 pounds of seed-cotton, and the staple is better.

The railroad furnishes convenient transportation to Savannah.

BRYAN.

Population: 4,929.—White, 2,368; colored, 2,561.

Area: 400 square miles.—Woodland, all; pine barrens (wire-grass), 228 square miles; savanna, 102 square miles; live oak, marsh, and islands, 70 square miles.

Tilled lands: 15,588 acres.—Area planted in cotton, 764 acres; in corn, 5,000 acres; in rice, 4,999 acres; in oats, 1,786 acres.

Cotton production: 304 bales; average cotton product per acre, 0.40 bale, 567 pounds seed-cotton, or 189 pounds cotton lint.

In Bryan county, on the coast, the marsh and live-oak lands cover the islands and extend inland for several miles. The savannas or pine flats form the largest part of the county, and extend inland to near the north corner, the northwestern part of the county being in the pine and wire-grass country. This region widens out as it passes northeastward into the adjoining counties and into South Carolina, its limit forming a line almost north from Hinesville, in Liberty county, through Bryan.

The slightly rolling pine and wire-grass lands on the northwest occupy the terrace that passes southward from Jenks' bridge, on the Ogeechee river, into Liberty county. This terrace is 50 feet above the savannas on the north, but only about 20 feet above where it enters Liberty county. It does not present a regular front, but is merely a low and broken upland, contrasting strongly with the low and flat lands of the savannas.

The lands of the open wire-grass and pine regions are sandy, and contain much ferruginous gravel. The county has about 15 per cent. of irreclaimable swamp; the lowland growth is pine, magnolia, red bay, live oak, cedar, and cabbage palmetto. But 6.1 per cent. of the county area is under cultivation, and that mostly in corn and oats. The acreage of cotton is small, averaging but 1.9 acres per square mile. The lands are well adapted to sea-island cotton, but its culture, since 1861, has largely ceased, and turpentine making and lumbering are now the chief industries.

Tide-water extends about 10 miles above the coast marshes on the Ogeechee river, and the tide swamps are largely devoted to rice culture.

Transportation is furnished by means of the railroad to Savannah, or by boats down the rivers to the coast.

ABSTRACT FROM THE REPORT OF A. G. SMITH, OF MALDEN BRANCH.

All the land of this region may be called lowland. With the exception of the bottoms, the lands are higher along the water-courses than elsewhere. Even the pine lands are low and level, and much is sandy and poorly drained. The cotton-plant, though very fine, is often scantily fruited. Summer rains, followed by hot weather, cause shedding of bolls.

The chief cotton lands are the hummocks along rivers and creeks and the higher bottom lands. They are commonly designated *pine and wire-grass lands*, and bear a natural growth of pine and scrubby oaks. One-fourth of the region is of this kind. The soil is a fine and coarse sandy loam of a brown color, and is 8 inches thick. The subsoil is like the surface soil, except that it has a greater proportion of yellow sand. The soil is warm but ill drained, and is easily cultivated if not too wet. The chief crops of the region are corn, cotton, and rice. The soil is apparently best adapted to rice, which occupies one-fourth of the tilled area. The cotton-plant grows from 3 to 4 feet high, and is generally most productive at 4 feet. Too much rain causes it to run to weed, the remedy consisting in drainage. From 600 to 800 pounds is the product of seed-cotton per acre of fresh land. Old land produces from 400 to 600 pounds per acre, and the amount needed for a 475-pound bale varies from 1,425 to 1,545 pounds. There is no observable difference in the quality of staples from fresh and from old lands. Crab-grass in great abundance is the only troublesome weed. One-tenth of such land originally cultivated lies "turned out", and when again cultivated produces very well for two or three years.

Cotton is shipped, when ginned, mostly by wagons to Savannah.

CHATHAM.

Population: 45,023.—White, 17,494; colored, 27,529.

Area: 400 square miles.—Woodland, all; about 200 square miles of savannas and 200 square miles of live-oak and coast lands.

Tilled lands: 23,496 acres.—Area planted in cotton, 289 acres; in corn, 2,224 acres; in oats, 619 acres; in sweet potatoes, 758 acres; in rice, 8,069 acres.

Cotton production: 65 bales; average cotton product per acre, 0.22 bale, 321 pounds seed-cotton, or 107 pounds cotton lint.

Chatham county lies between the Savannah and Ogeechee rivers, and reaches the immediate coast. It is included entirely in the savanna and live-oak regions, the latter including in its limits the city of Savannah, whose parks are well shaded with the magnificent live-oak growth. The county resembles in its features the other counties of the coast belt, and a repetition is not necessary. (See general description and analysis of soil, page 52.)

The city of Savannah has several cottonseed-oil mills and cotton compresses, and probably receives, for shipment to foreign markets, the greater part of the cotton production of the state.

ABSTRACT FROM THE REPORT OF GEORGE P. HARRISON, OF SAVANNAH.

The fresh-water overflowed lands of this county are very fertile; the sea islands and uplands are devoted to cotton culture. This soil is a *gray, fine sandy loam*, 6 inches thick, and covers about one-fourth of this region, extending 100 miles north and south and 20 miles east and west. Its natural growth is live and other oaks, magnolia, sweet gum, and pine. The subsoil is an impervious, brownish clay in some places, in others it is a leachy, yellowish sand; in either case the same kind of material continues to greater depths. Tillage is easy at any time, and the soil is early, warm, and for the greater part well drained. The chief crops are rice and garden produce for the northern markets. The lowlands are apparently best adapted to rice, the sandy lands to garden produce. The most productive and usual height of the cotton-plant is 5 feet. The tendency to run to weed, whatever the cause may be, is a peculiarity of the coast region, but it prevails to a greater degree in wet seasons. The remedy consists in topping. Fresh land produces 475 pounds of seed-cotton per acre. The production of old land varies with cultivation and manuring. There is little or no difference between old and fresh land so far as the quality of staple and ratio of seed to lint are concerned. About seven-tenths of such land originally cultivated now lies "turned out", but with a little manure produces very well when again cultivated. Crab and Bermuda grasses are the most troublesome weeds.

PART III.

CULTURAL AND ECONOMIC DETAILS

OF

COTTON PRODUCTION.

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REFERENCE LIST

OF

NAMES AND ADDRESSES OF CORRESPONDENTS.

NORTHWEST GEORGIA.

Murray.—WILLIAM J. JOHNSON, Spring Place, January 17, 1880.
Catoosa.—W. J. WHITSITT, Ringgold, February 10, 1881.
Dade.—T. J. LUMPKIN, M. D., Rising Fawn, March 25, 1879; W. A. CHAMBERS, Morganville, December 23, 1880.
Walker.—F. M. YOUNG, Greenbush, January 19, 1880; J. A. CLEMENTS, Villanow, December 23, 1879; W. F. TAPP, Valley Store, Chattooga county, February 7, 1880.
Chattooga.—A. P. ALLGOOD, Trion Factory, April 21, 1880; C. D. HILL, Raccoon Mills, January 4, 1880.
Bartow.—A. F. WOOLLEY, Kingston, January 25, 1880; J. O. MCDANIEL, Allatoona, February 2, 1880.
Floyd.—GEORGE S. BLACK, Rome, April 22, 1880; JOHN H. DENT, Cave Spring.
Polk.—T. J. THOMPSON, Rockmart, January 1, 1880; S. M. H. BYRD, Cedartown, December 16, 1879.
Gordon.—AARON ROFF, Calhoun, January 27, 1881.

METAMORPHIC OR BLUE RIDGE AND MIDDLE GEORGIA REGION.

Towns.—J. W. HOLMES and HOWELL C. STANDRIDGE, Hiawassee. (No details.)
Fannin.—ADAM DAVENPORT, Morganton, December 16, 1879.
White.—J. H. NICHOLS, Nacoochee. (No details.)
Union.—C. J. WELBORN, Blairsville, January 8, 1880.
Lumpkin.—J. C. BRITTAIN, Dahlonega. (No details.)
Habersham.—C. H. SUTTON, Clarksville, December 15, 1879.
Franklin.—O. C. WYLY, Carnesville.
Hart.—C. W. SEIDELL, Hartwell, January 10, 1880.
Banks.—C. C. SANDERS, Gainesville, Hall county, June 19, 1880.
Hall.—Dr. M. F. STEPHENSON, Gainesville, December 20, 1879.
Forsyth.—H. C. KELLOGG, Pleasant Grove, January 8, 1880.
Cherokee.—M. S. PADEN, Woodstock, January 5, 1880; ELIAS C. FIELD, Canton, July 5, 1880.
Madison.—R. M. MERONY, Danielsville, February 14, 1880.
Elbert.—ROBERT HESTER, Elberton.
Jackson.—E. M. THOMPSON, Jefferson, February 6, 1880.
Clarke.—Prof. DAVID C. BARROW, JR., Athens, September 29, 1880.
Oglethorpe.—WILLIAM L. JOHNSON, Stephens, February 10, 1880.
Wilkes.—JOHN T. WINGFIELD, Washington, April 5, 1880.
Lincoln.—C. R. STROTHER, Lincolnton, January 1, 1880; N. A. CRAWFORD, Lincolnton, January 15, 1880.
Walton.—R. H. CANNON, Walnut Grove, November 20, 1880.
Gwinnett.—R. D. WINN, Lawrenceville, December 25, 1879.
Cobb.—JAMES ROSWELL KING, Roswell, March 20, 1880; H. M. HAMMETT, Marietta, December 10, 1879.
Paulding.—J. R. PREWETT, Dallas, July 8, 1880.
Haralson.—W. C. MCBRAYER, Draketown, July 8, 1880.
Carroll.—R. H. SPRINGER, Whitesburg, December 21, 1879.
Douglas.—F. M. DUNCAN, Douglasville, June 26, 1880; J. E. HENLEY, M. D., Campbellton, June 18, 1880.
Fulton.—THOMAS MOORE, Boltonville, December 22, 1879; J. C. TUCKER, Ben Hill post-office, January, 1880.
De Kalb.—T. J. FLAKE, Panthersville, December 26, 1879; F. A. RAGSDALE, Lithonia, January 22, 1880.
Rockdale.—WILLIAM L. PEEK, Conyers, January 26, 1880.
Newton.—JESSE W. WALKER, Social Circle, Walton county, January 10, 1880; LEONIDAS F. LIVINGSTON, Covington, July 1, 1880.
Morgan.—GRANT D. PERRY, Madison, February 4, 1880.
Greene.—J. B. Y. WARNER, Greensboro', February 12, 1880.
Taliaferro.—LIONEL L. VEAZY, Crawfordsville, May 6, 1880.
Columbia.—H. R. CASEY, Appling, January 1, 1880.
McDuffie.—A. E. STURGIS, Thomson, March 29, 1880.

Warren.—JOHN S. JOHNSON, Warrenton, December 25, 1879; JAMES A. SHIVERS, Warrenton, December 29, 1879.
Putnam.—J. T. DENNIS, Eatonton, March 27, 1880; ROBERT C. HUMBER, Eatonton, January 6, 1880.
Jasper.—WILLIAM D. MADDOX, Monticello, March 29, 1880; WILLIS NEWTON, Shady Dale, December 15, 1879.
Henry.—J. A. C. WYNN, Wynn's Mills, December 30, 1879.
Fayette.—ISAAC G. WOOLSEY, M. D., Fayetteville, July 1, 1880.
Spalding.—J. M. KELB, S. R. GRAY, and H. T. PATTERSON, Sunny Side, February 24, 1880.
Coweta.—BENJAMIN LEIGH, Newnan, December, 1879; AUGUSTUS W. STOKES, Newnan, January 1, 1880.
Heard.—R. H. JACKSON, Franklin, June 10, 1880.
Troup.—WILLIAM P. BEASLEY, La Grange; C. W. MABRY, La Grange, January 1, 1880.
Meriwether.—J. E. G. TERRELL, Greenville.
Baldwin.—JAMES C. WHITAKER, Milledgeville, March 5, 1880.
Upson.—E. W. ROSE, The Rock, June 19, 1880; THOMAS J. MIDDLEBROOKS, Barnesville, December 28, 1879.
Harris.—JAMES W. MOBLEY, Hamilton, January 22, 1880.
Talbot.—WILLIAM H. ELLISON, Shiloh, Harris county, January 5, 1880; W. M. GORMAN, Geneva, June 17, 1880.
Crawford.—B. LE SUEUR, Knoxville, April 20, 1880.
Bibb.—W. D. H. JOHNSON, Bolingbroke, February 9, 1880.
Muscogee.—JAMES C. COOK, Columbus, January 5, 1880.
Hancock.—W. J. NORTHEN, Sparta, October 30, 1880.
Monroe.—R. C. MCGOUGH, Forsyth, February 17, 1881.

CENTRAL COTTON REGION.

Richmond.—A. H. MCLAWS, Augusta, March 31, 1880.
Burke.—J. B. JONES, Herndon, February 13, 1880; W. B. JONES, Herndon, January 2, 1880.
Jefferson.—A. E. TARVER, Bartow, March 12, 1880.
Glascock.—JAMES L. NEAL, Warrenton, Warren county, July 12, 1880.
Washington.—H. N. HOLLIFIELD, Sandersville, February, 1880.
Wilkinson.—T. N. BEALL, Irwinton, June 1, 1880.
Twiggs.—F. D. WIMBERLEY, JR., Twiggsville, April 15, 1880.
Laurens.—ROBERT WAYNE, Dublin, December 27, 1879; J. F. CHAPPELL, M. D., Laurens Hill, March 15, 1880.
Taylor.—JAMES A. ADAMS, Reynolds, January 30, 1880.
Macon.—A. J. CHEVES, Montezuma, December 22, 1879.
Schley.—THOMAS F. RANEY, SR., Ellaville, January 5, 1880.
Marion.—GEORGE W. C. MUNRO, Buena Vista, March 30, 1880.
Chattahoochee.—J. A. WOOLDRIDGE, M. D., Jamestown, March 9, 1880.
Stewart.—W. H. TATUM, Hannahatchee, June 28, 1880.
Webster.—JAMES P. WALKER, Preston, August 21, 1880; JUBILEE SMITH, Preston, July 8, 1880.
Sumter.—SAMUEL S. BIRD, M. D., Americus; C. C. SHEPARD, Americus, March 6, 1880.
Quitman.—A. OGLETREE, Georgetown, March 4, 1880.
Randolph.—M. A. MCNULTY, Cuthbert, July 1, 1880.
Clay.—F. K. FREEMAN, Fort Gaines, June 10, 1880.
Calhoun.—W. A. BECKCOM, Arlington, March 1, 1880.
Dougherty.—Messrs. WELCH and BACON, Albany, July 2, 1880.
Early.—JOHN B. MULLIGAN, Blakely; DENNIS M. WADE, Blakely, February 23, 1880.

LONG-LEAF PINE AND WIRE-GRASS REGION.

Decatur.—JOHN E. DICKERSON, Bainbridge, December 22, 1879.
Thomas.—R. H. HARDAWAY, Thomasville, February 17, 1880; JAMES H. HAYES, Cairo, January 7, 1880.
Brooks.—R. I. DENMARK, Quitman, January 5, 1880.
Screven.—Hon. GEORGE R. BLACK, Sylvania, January 1, 1880; R. D. SHARPE, Parramore's Hill, December 20, 1879.
Johnson.—JAMES H. HICKS, Wrightsville, January 23, 1880.
Emanuel.—E. H. EDENFIELD, Swainsboro', June 19, 1880.
Montgomery.—E. MCRAE, Mount Vernon, June 12, 1880.
Dodge.—DAVID SAPP, Du Bois, July 9, 1880.
Telfair.—D. F. MCRAE, Sumter City.
Wilcox.—S. D. FULLER, House Creek, January 14, 1880.
Dooly.—JOHN H. WHITSETT, Vienna, February 2, 1880.
Worth.—WILLIAM A. HARRIS, Isabella, May 1, 1880.
Baker.—J. H. HAND, M. D., Leary, Calhoun county, February 14, 1880.
Mitchell.—W. W. SPENCE, Camilla, March 21, 1880.
Colquitt.—J. B. NORMAN, Moultrie, December 22, 1879.
Lowndes.—N. B. OUSLEY (late of Lowndes county), Fort Valley, Houston county, February 3, 1880.
Berrien.—HENRY T. PEEPLES, Nashville, December 22, 1879.
Coffee.—TIMOTHY FUSSELL, Kirkland, February 15, 1880; A. M. FRASER, Hazlehurst.
Appling.—BENJAMIN MILIKIN, Holmesville, July 7, 1880.
Pierce.—HENRY J. SMITH, M. D., Blackshear, December 13, 1879.
Wayne.—JAMES W. HARPER, Gardi, July 1, 1880; G. W. STANSELL, Jessup.
Tattnall.—JOHN HUGHEY, Reidsville, October 7, 1880; B. H. CLIFTON, Perry's Mills.
Bulloch.—J. F. BROWN, Ogeechee, October 16, 1880.
Effingham.—O. E. SMITH, Egypt, March 14, 1881.

COAST AND PINE-FLAT COUNTIES.

Chatham.—GEORGE P. HARRISON, Savannah, April 3, 1881.
Bryan.—A. G. SMITH, Malden Branch, March 28, 1881.
Liberty.—L. B. NORMAN, McIntosh, February 21, 1880; JAMES A. M. KING, Dorchester, January 24, 1880.
McIntosh—WILLIAM C. WYLLY, Darien.
Clinch.—P. STOTESBURY, Stockton, January 30, 1880.
Echols.—JOHN HERNDON, Statenville, May 12, 1880.
Camden.—JOSEPH SHEPARD, Saint Mary's, January 3, 1880; E. A. MCWHORTER, Saint Mary's, December 31, 1879.

ADDITIONAL NAMES.

Appling.—J. J. CARTER, Baxley.
Brooks.—S. M. GRIFFIN, Quitman.
Burke.—J. H. DANIEL, Millen.
Clinch.—J. TOMLINSON, Homerville.
Coweta.—R. F. MILLER, Newnan.
Dade.—A. W. SHERRILL, Rising Fawn.
Dodge.—J. M. SAPP, Eastman.
Elbert.—J. H. DUNCAN, Elberton.
Forsyth.—F. H. NICHOLS, Cumming
Glynn.—R. M. TISON, Jamaica.
Liberty.—J. E. SHEPPARD, Hinesville.
Lowndes.—J. S. BARNETT, Valdosta.
Morgan.—N. E. RHODDY, Rutledge.
Putnam.—S. C. PRUDDEN, Eatonton.
Rabun.—F. A. BLECKLEY, Clayton.
Troup.—J. F. JONES, Hogansville.
Washington.—J B. ROBERTS, Sandersville.

SUMMARY OF ANSWERS TO SCHEDULE QUESTIONS.

(The subject-matter embraced in this division of the report consists simply of a summary of the answers to schedule questions combined in such a manner as to avoid repetition and present the facts as concisely and clearly as possible. When of special interest, extracts are made from these answers, and the name of the county is added in parenthesis.

There are one hundred and twelve counties represented in these answers, nothing having been heard from parties in the other twenty-five to whom questions were sent.)

TILLAGE, IMPROVEMENT, ETC.

1. What is the usual depth of tillage (measured on land-side of furrow) and draft employed in breaking up?

NORTHWEST GEORGIA: 5 to 6 inches in all counties except Gordon, which is 3 inches; 2 horses or mules generally, often with 1.

METAMORPHIC REGION: 2 inches in Madison and Greene, 3 inches in sixteen counties, 3½ inches in Douglas, Putnam, and Harris, 4 inches in seven, 5 inches in seven, 6 to 7 inches in eleven counties, and about 8 inches in Cobb and Taliaferro counties; generally with 1 and exceptionally with 2 horses or mules in thirty-seven counties, with 1 or 2 horses or mules in seven counties, and with 2 horses or mules in two counties (*Fannin* and *Haralson*).

CENTRAL COTTON BELT: 2 inches in three counties, 3 inches in nine counties, 4 inches in three counties, 5 inches in seven counties: 6 inches in Schley, and 10 inches on the bottom lands of Richmond; 2 horses in Richmond and Washington, and 1 horse or mule generally, and 2 exceptionally, in all other counties.

LONG-LEAF PINE AND COAST COUNTIES: 2 inches in Johnson and Pierce, 3 to 4 inches in thirteen counties, 5 to 6 inches in fifteen counties; usually with 1 horse or mule.

2. Is subsoiling practiced? If so, with what implements, and with what results?

NORTHWESTERN REGION: All of the counties except Dade and Catoosa, where the practice is said to be general, report very little subsoiling, though on the increase in some. The implements used are two-horse plows, long scooters, bull-tongue, colter or winged colter plows. The following extracts are given: The results of subsoiling are good. Besides increasing production, it enables crops better to endure excessive wet or dry seasons (*Murray* and *Walker*). Equal to an addition of 200 pounds of the best of fertilizers per acre (*Walker*). Does not seem to benefit the crops much, but makes after-cultivation easier and the soil less liable to wash (*Polk*).

METAMORPHIC REGION: In only fourteen of the counties is subsoiling practiced to any great extent. The implements used are the same as in the northwestern region, with the addition of the Avery, Brinley, diamond point, and square-pointed plows. The results are reported good in all counties except Hancock. The production is increased from 25 to 40 per cent. (*Warren* and *Hall*). Cultivation made easier (*Forsyth* and *Upson*). It so breaks the clay subsoil that the roots of cotton may go deeper and better endure drought, besides increasing the production (*Newton*, *Troup*, *Gwinnett*, *McDuffie*, *Heard* and *Baldwin*).

CENTRAL COTTON BELT: Very little subsoiling is practiced in this region, in nine of the counties there being none at all. The implements are similar to those used in the metamorphic region. With four exceptions the results are good. "It does not pay" (*Twiggs* and *Laurens*). Not very favorable (*Schley*). Doubtful (*Sumter*). On stiff and hard-pan lands the production is increased 50 per cent. (*Glascock*). Good in dry seasons (*Marion*). Satisfactory where the subsoil is clayey, the yield being greatly increased (*Webster*). Good on red lands (*Randolph*).

LONG-LEAF PINE REGION AND COAST COUNTIES: It is done to some extent in but few of the counties, the implements being the Avery, Watt, Brinley, and other subsoil plows. If the subsoil is pebbly, the results are good; otherwise it is injurious (*Pierce*). The soil is injured by deep plowing (*Liberty*). The soil and subsoil are both sandy, and subsoiling is unnecessary (*Appling*).

3. Is fall plowing practiced, and with what results?

NORTHWEST GEORGIA: Yes; to various extents in all the counties except Gordon. It is not believed to be beneficial to cotton, and is not practiced for cotton in Murray. "A little; it is of little benefit to crops, and it makes rolling lands more liable to wash" (*Polk*). All others report results as very satisfactory, especially when vegetation is turned under. Nearly all the deep plowing is done in fall and winter (*Dade*). It makes after-cultivation much easier (*Walker*).

METAMORPHIC REGION: It is practiced but little generally, and not at all in the counties of Oglethorpe, Walton, Jasper, Heard, Baldwin, and Hancock. Results are reported good from all other counties, especially when vegetation is turned under. Stiff clayey lands are especially benefited by freezes and thaws after fall plowing (*Cherokee, Clark,* and *Muscogee*). It is profitable, but few can spare the time required for it (*Lincoln*). It would be generally practiced were not the labor all engaged in picking cotton (*Columbia, Fayette, Gwinnett, Troup,* and *Upson*). It adds one-fourth to the yields (*Fulton*). It checks the progress of weeds by turning them under before their seeds ripen (*Newton* and *Monroe*). Results are unfavorable only where heavy rains wash the soil (*Morgan*). It is indispensable in preparing land for wheat or rye (*Troup*).

CENTRAL COTTON BELT AND LONG-LEAF PINE REGION: To but a small extent throughout these counties. Only when preparing to sow small grain (*Laurens, Webster,* and *Montgomery*). It is good for level clay lands (*Marion*).

COAST AND PINE FLATS: It is practiced in seven counties. Results are good if green weeds are turned under (*Chatham*). It checks damages by cut-worms and other pests (*Wayne*). The effect sometimes equals a dressing of manure (*Pierce*). Only in preparing the soil for oats (*Clinch*).

4. Is fallowing practiced? Is the land tilled while lying fallow, or only "turned out", and with what results in either case?

In thirty-two counties of the state it is not done at all, in twenty counties very generally, and in the remainder to some extent. Sometimes the land is tilled while lying fallow, and in nearly all cases, whether tilled or "turned out", a marked improvement is observed. "If the land lies idle one year after a crop of wheat or oats the cotton crop is increased fully 10 per cent." (*Warren*). In the exceptional cases of fallowing, land has increased in production 25 per cent. in five years (*Hancock*). Merely "turning out" does not improve the land (*Webster*). Tillage while "lying out" consists in turning under the weeds in late summer or fall. In one instance the yield was increased from 5 to 42 bushels of corn, or from 200 to 2,000 pounds of seed-cotton per acre. The land had lain fallow nine years (*Pierce*).

5. Is rotation of crops practiced? If so, of how many years' course, in what order of crops, and with what results?

NORTHWEST GEORGIA: Yes; generally with cotton, corn, small cereals, sweet potatoes, and clover, in courses usually of two years, and in no special order of crops. In Murray the course is four years, the order being cotton, corn, oats, and wheat or rye. In other counties small cereals usually follow corn or cotton. The results are reported to be "favorable", except in Walker county, where it is claimed "rotation is fast wearing out our lands". "Even hillsides protected against washings would long maintain fertility if rotation were thus practiced in their cultivation" (*Bartow*). Everything does better, corn is sounder, and the soil does not wash so badly (*Polk*).

METAMORPHIC REGION: Yes; very generally in all the counties except Greene, Putnam, and Heard, where the correspondents report the system but little practiced. The usual course comprises three years, and mostly in the order of cotton, corn, and wheat or oats. In Forsyth, Cherokee, Madison, Wilkes, Walton, Cobb, Warren, and Troup cotton is reported as planted for several successive years before any other crop takes its place. In Warren and Jasper the land is allowed to rest every fourth year. In Haralson and Newton "four years of rotation" is practiced, oats following wheat. It is very generally stated that cotton is more productive when it is planted after a crop of wheat. The system of rotation is not regular, and seems to be resorted to as a relief to the soil after an exhaustive cotton crop; and in Oglethorpe county only on small farms. Good results in increased crops are universally reported. "Land is kept more free from weeds, and fertility is longer maintained" (*Fannin, Lincoln,* and *Putnam*). It is believed to be most profitable always to keep some of the land in cotton (*Cherokee* and *Newton*). Lands are improving in fertility at the rate of 10 per cent. every four years (*Fulton*). After the wheat harvest, pease are sown and the vines turned under in the fall, thus improving the lands by the addition of vegetable matter (*McDuffie*). If rotation were practiced, and the soil allowed a year's rest after the wheat crop, the cotton yield would be increased 10 per cent. (*Warren*). The washing of the soil is greatly diminished (*Upson*).

CENTRAL COTTON BELT: The counties of Richmond, Burke, Jefferson, Glascock, Washington, Laurens, Talbot, Taylor, Marion, Quitman, Randolph, and Dougherty answer "yes", other counties "to a limited extent", and with no general system of rotation. A three years' course in rotation is very general throughout the region, and the several crops of corn, oats, potatoes, etc., are used. In Richmond and Stewart cotton is planted every second year, alternating with other crops. In Washington and Schley cotton is succeeded by corn, wheat, or oats, and then the land is allowed to rest for a year, while in other counties no rest is given. Laurens, Talbot, and Webster report the order to be corn, cotton, and small cereals, while Sumter claims that "no advantage is observed by planting cotton after corn". In Calhoun "wheat rusts so badly that it does not pay to sow it". Rotation enables the soil to maintain its productiveness longer (*Burke*). If the land is not manured the crops must be changed each year (*Glascock*). Land improved and production increased (*Talbot*). Where the change is from shallow to deep-rooted plants, or *vice versa*, the results are good (*Marion*). To produce wheat the land is manured as much as possible with compost and cotton-seed; as a result, double the usual yield is sometimes produced (*Webster*).

LONG-LEAF PINE AND WIRE-GRASS REGION: "Yes; to some extent," in all of the counties except Telfair and Wilcox, where either resting or planting in wheat is practiced every fourth year; and in Screven, Brooks, Dodge, and Coffee, where corn, sweet potatoes, and oats alternate with cotton. The usual course is three years, and in the order of cotton, corn, and oats or wheat in most of the counties. In Lowndes some of the farmers use fertilizers and never vary from continuous cotton planting. The results of rotation are always reported "excellent". Crops are increased 20 per cent. (*Screven*). The land improves and production increases (*Appling, Berrien,* and *Worth*).

COAST AND PINE-FLATS REGION: "Not generally" in Bryan and Wayne; "sometimes" in Liberty and Pierce, and "yes" in other counties, but with no regular system. Cotton, corn, and oats; cotton never follows pease or sweet potatoes, because it is then subject to rust if that disease prevails (*Liberty*). After a dressing of cow-pen manure, corn or sugar-cane is planted, then cotton or sweet potatoes.

6. What fertilizers or other direct means of improving the soil are used? Is green manuring practiced? What are the results in either case?

NORTHWEST GEORGIA: Fertilizers are scarcely used in the northern counties of Dade, Walker, and Catoosa, and then only with cotton crops. In other counties the use of commercial brands and composts of these with manure and cotton-seed is becoming very general. But little green manuring is practiced, though with cow-pease and clover the results are acknowledged to be good. Extracts: Commercial or other fertilizers are invariably used in the production of cotton; without them, not more than half the bolls would open. The slaty black-jack lands would produce almost nothing without fertilizers. For other crops than cotton barnyard manure is applied, and green manuring with cow-pease is practiced, always with good results (*Murray*). Production is increased one-sixth to one-fourth (*Dade*). Production increased 50 per cent. The first and second crops, after manuring, are improved (2 *Walker*). Will add, in a good season, 50 to 100 per cent. to the yield when properly applied (*Bartow*). Has stimulated and increased the production of cotton in this region; they increase the yield one-third (*Floyd*). Green manuring results in an increase of the following crop only (*Polk*).

METAMORPHIC REGION: Commercial fertilizers are used very generally in all of the counties, either alone or in composts, and an increase of production is reported varying from 35 to 75 per cent. Composts of barnyard manure, pine straw, leaves, and the like, with commercial fertilizers, are coming into general favor. In eighteen of the counties green manuring is reported to be in practice, while in all of the others very little is done. Cow-pease alone are turned under, except in the northern counties. The following results are reported: Green manuring improves succeeding crops (*Union*). The land improves more by lying fallow than by green manuring (*Elbert*). It is considered by some to be the best and most economical method of maintaining the fertility of the soil (*Wilkes*). It is for wheat the cheapest of all manures. Some planters sow cow-pease in the corn-field while the corn is being laid by, then plow them under while sowing wheat; the effect on the wheat is good (*Fulton*). Green manuring makes cultivation easy and improves the crops (*Newton*). It improves the land and crops for several years (*McDuffie*). It doubles the small cereal crops (1 *Warren*). Wonderful results are obtained by turning under one crop of cow-pease; it is equal to a dressing of bone fertilizer (1 *Putnam*). The results of the use of fertilizers are thus given: They make a climate (*Hall*). The best farmers use them and would not be without them (*Clarke*). Farmers are compelled to use them to make good yields (2 *Cobb*). The home-made manures are more durable in their effects than the others (2 *Douglas*). The composts are preferred (2 *Fulton*). They are used for the benefit of the crops, and not for any lasting addition to the soil (1 *De Kalb*). The use of commercial fertilizers is now declining, and farmers are beginning to use barnyard manure and composts made at home (1 *Newton*). They double the production of the unaided soil (2 *Newton*). They increase the crops but not the net profits of farming (*Columbia*). Results are best from composts (*Fayette*). They make farmers of this region poorer each year (1 *Troup*).

CENTRAL COTTON BELT: Commercial fertilizers are used in all of the counties. Composts, made by combining other material with them, are also in general favor, some correspondents claiming a better yield. Green manuring is but seldom practiced, though the results are admitted to be good, especially to the succeeding crop. The following results are given regarding the use of fertilizers: Commercial fertilizers cause cotton to mature much earlier, and are especially advantageous on river lands. Green manuring is practiced with cow-pease; a few farmers sow grain without first turning under the pease, and the latter die and rot on the surface; the grain comes up well and the practice is growing in favor (*Richmond*). Fertility of the soil is maintained (*Jefferson*). Crops are improved 50 per cent. (*Glascock*). Crops are increased 25 per cent. (*Macon*). Results uncertain (*Chattahoochee*). Production increased 10 to 25 per cent. (*Stewart* and 1 *Webster*). Increased production from 100 to 200 per cent. (2 *Webster*).

LONG-LEAF PINE AND WIRE-GRASS REGION: Commercial fertilizers and composts are very generally used in all of the counties of this region, and always with excellent results. Green manuring is not practiced in Dooly and Baker, and but seldom in other counties, except Brooks and Telfair, where it seems to be popular. The effects are always "excellent" where it is properly done. The following replies are given: The barnyard compost is always a success; the others are variable. In green manuring the native weeds have done better than pease (*Lowndes*). Some favorable and some unfavorable results have been obtained with fertilizers, and fine results from green manuring (*Brooks*). Crops are increased 50 to 75 per cent. by the use of fertilizers (2 *Thomas*). Results depend much on the seasons (*Decatur*). Fertilizers increase production 50 per cent.; green manuring, 20 per cent. (2 *Screven*). Green manuring is equal to the addition of 50 pounds of guano per acre (*Telfair*). Cow-pease are turned under in the fall, for the benefit of the succeeding crop (*Berrien*).

COAST AND PINE FLAT REGION: Fertilizers are in general use, both commercial and home-made, the latter being preferred. Green manuring is practiced in all of the counties to some extent, except Bryan and Wayne. The following extracts are given: Composts and marsh muck are used; more and better lint is the result, and cotton-plants are more free from diseases. Muck is the most durable, its effects being observed for years. Green manuring is followed with only moderate results on the sandy lands (2 *Liberty*). Chiefly those found locally, such as pond muck and cotton-seed (*Wayne*). Composts pay from 50 to 100 per cent. (*Clinch*). Composts of manure and leaves and straw are used (2 *Camden*).

7. How is cotton-seed disposed of? If sold, on what terms and at what price?

Little, if any, cotton-seed leaves the state, but is very generally used for fertilizing purposes, both alone and in composts. It is also largely fed to stock, especially in the northern counties, where its value to the soil has not as yet been felt. Prices vary from 8 to 12 cents, and depend usually upon the market price of cotton, a pound of lint and a bushel of seed being considered of the same value. For planting purposes the price is sometimes as much as 25 cents (for sea island variety). The following extracts are given: The farmers here are beginning to realize the importance of utilizing their cotton-seed as a fertilizer, and but little is now allowed to be removed from the farm where it is produced. Intelligent and advanced farmers estimate cotton-seed to be cheaper, even at 20 cents per bushel, than any commercial fertilizer in the market. The most popular mode of using it is to sow broadcast, at the rate of about 25 or 30 bushels per acre, and plow it in with wheat or oats. For growing corn or cotton it is composted with stable or barnyard manure and acid phosphate, and this is perhaps the most economical method of using cotton-seed (*Floyd*). Many owners now furnish tenants and share-laborers with cotton-seed as manure at the beginning of the season, and retain all that is produced in the fall. This method works well (*Polk*). The cheapest and easiest way of maintaining the fertility of the soil is by sowing cotton-seed with wheat or oats, then, without pasturing, turn under the green crop (*Newton*). It is generally thrown out of the gin-house to rot, and then hauled out as manure. A few planters apply it to corn land without rotting (*Baker*).

NEAREST OIL-MILL: The only oil-mills in the state are located in Savannah and in Augusta. There are others in Montgomery and Selma, Alabama, and in New Orleans.

8. Is cottonseed-cake used with you for feed? Is it used for manure, alone or composted, and for what crops?

It is not used at all in sixty-two counties of the state. In the others it is to some extent made to serve purposes both of feed and of manure. Two bushels of it mixed with one of corn-meal makes a good feed (*Webster*). Not unless cotton-seed is scarce, then it is fed to cows after boiling and soaking. It is used for manure, either alone or mixed with muck, pine straw, fence-corner scrapings, and trash of all kinds, chiefly for growing corn (*Pierce*).

PLANTING AND CULTIVATION OF COTTON.

9. What preparation is usually given to cotton land before bedding up?

NORTHWEST GEORGIA: Fall plowing on stubble land in all of the counties except Gordon and Chattooga, where no preparation is given. Fallow land is turned over in the fall; in other cases the land is generally well broken before bedding up (*Murray*). Fall plowing to turn under stubble; otherwise spring plowing and harrowing (3 *Walker*). None; generally a furrow is opened, into which manure is distributed, and upon which the bed is formed just before planting (2 *Chattooga*). Fall plowing with 2 horses on stubble land, or spring plowing with 1 horse on clean land before bedding up (*Bartow*).

METAMORPHIC REGION: Fall plowing in Jackson and Wilkes (with 2-horse plows) and Coweta (on stubble land), and occasionally in other counties. Spring plowing usually in all of the counties, unless the previous crop was cotton, when in Hall, Lincoln, Clarke, Morgan, Greene, Columbia, Henry, Crawford, Talbot, Harris, Bibb, Hancock, and Monroe the land is simply bedded. Bedding up is preceded by deep plowing (*Warren*). The surface is cleared of rubbish; the row furrows are opened with shovel-plows, guano distributed in them at 200 pounds per acre, and this is bedded upon (*Troup*). Thorough plowing close and deep in the fall or spring (*Baldwin*). Broadcast plowing in winter chiefly (*Upson*). Knocking down stalks and plowing in spring (*Muscogee*). Farmers are too busy to plow in the fall (*Monroe*). First locate the beds by running off furrows 4 feet apart with a shovel-plow as deep as it can be done, and into these furrows another is put with a bull-tongue plow, and also on each side. Fertilizers are put into these rows, and the land bedded over them with a larger turn-plow (2 *Lincoln*).

CENTRAL COTTON BELT: No preparation is given in Richmond, Macon, Chattahoochee, Stewart, Sumter, Quitman, Clay, Early, and Dougherty (rarely), spring plowing usually in others. Land broken broadcast in winter (*Jefferson*). Five per cent. of the lands are plowed in the fall and 50 per cent. in spring, and 45 per cent. is bedded up without plowing (*Glascock*). Spring plowing if the preceding crop was corn or small grain; but if cotton, the old rows are simply barred off (*Twiggs*). Two furrows are thrown together with turning plows in the spring (*Laurens*). Some break the land before bedding up; others simply rebed the land of the previous season (*Taylor*). Chiefly deep, broadcast plowing in the spring (*Warren*). About April 1 the land is marked off in rows 2½ or 3 feet apart, and guano drilled in at the rate of 100 to 200 pounds per acre (*Webster*).

LONG-LEAF PINE AND WIRE-GRASS REGION: No preparation in Baker, Mitchell, Colquitt, Brooks, Emanuel, Montgomery, Appling, and Berrien; spring plowing in most of the other counties. Fall plowing rarely; spring plowing sometimes, first broadcast, but generally ridging originally (*Screven*). Stubble land is plowed; where cotton is again planted the land is simply rebedded (*Lowndes*). Thorough plowing (*Dodge*). Breaking down the stalks and plowing (*Wilcox*).

COAST AND PINE-FLAT REGION: No preparation in Bryan, Wayne, Echols, and Camden. Fall plowing in Chatham, sometimes in Pierce, to turn under grasses and weeds. Breaking down weeds and spring plowing; fall plowing supposed to be one cause of rust (*Liberty*). Stalks pulled up and burned (*Wayne*). Stalks, if small, knocked down; if large, burned. Spring plowing diagonally (*Clinch*).

10. Do you plant in ridges, and how far apart?

Planting in ridges is the prevailing custom throughout the state, a few counties only reporting otherwise, or preferring simple drills. The distance allowed between the rows is from 30 to 48 inches, and varies with the character of land, 5 and 6 feet being given on bottom lands.

11. What is your usual planting time?

The earliest dates given are March 10 in Hart; March 15 in Richmond, Calhoun, Dougherty, Baker, Thomas, Colquitt, Pierce, Clinch, and Camden; April 1 in Union, Hall, Carroll, Newton, Troup, Meriwether, Burke, Wilkinson, Macon, Schley, Webster, Sumter, Quitman, Clay, Early, Liberty, Wayne, and Echols; April 5 in Bartow, Polk, Cherokee, Haralson, and Upson; April 10 and 15 in all other counties of the State, except Dade, where planting is done from May 1 to May 20. June 10 is the latest limit of the planting season in McDuffie and Appling. In other counties from May 10 to May 15, except on the coast, where April 30 is the date given.

12. What variety of seed do you prefer?

The following varieties of short-staple cotton are given, and the number of times each is mentioned: Dixon's Cluster or Prolific, 61 times; Simpson, 12; Boyd's Prolific, 4; Peeler, 3; Petit Gulf, 3; Hurlong, 5; Cheatham, 3. Others are simply given as prolific or cluster varieties. The sea-island or black seed is used in the coast counties. Varieties from a more southern climate (*Banks*). Dixon's limby cotton does not shed as readily as the cluster variety in times of drought (*Rockdale*). The small seed variety does not drop out as easily and yields as much per acre; the staple is equal to other varieties, and has a larger proportion of lint (*Webster*). Early varieties are sought for, for the purpose of having the crops matured before the appearance of the caterpillar (*Dougherty*). Green-seed or upland short-staple can be profitably planted on compact soils on the coast (*Liberty*). Sea-island produces better and seems best adapted to the coast region (*Camden*).

13. How much seed is used per acre?

The amounts vary greatly throughout the state, from one-half a bushel to 4 bushels. Except with choice seed, or with the use of "planters", no care is taken to prevent waste. The seed is scattered thickly in the drills either by hand or through a tin funnel, and when up the plants are thinned out.

14. What implements do you use in planting?

Cottonseed-planters are used in Catoosa, Walker, Bartow, and Gordon of northwest Georgia, nineteen counties of the metamorphic region, nine of the central cotton belt, and ten of the long-leaf pine and coast counties. In all others the furrows are opened with a small plow, and planting is done mostly by hand. The seed is then covered with a board, scraper, or harrow. "A plow to each trace laying off two rows at once, and a stout board with shafts covering two rows" (*Twiggs*).

15. Are "cottonseed-planters" used in your region? What opinion is held of their efficacy or convenience?

NORTHWEST GEORGIA: They are used and commended to some extent in all the counties except Dade, where but little cotton is planted. In Walker "they are almost indispensable" and "an advantage every way". In Chattooga and Bartow they are regarded as "efficient, convenient, and labor-saving machines; they make after-cultivation convenient, but they are best on smooth land". Some find fault with them in Polk, but they are approved generally by those who use them.

METAMORPHIC REGION: They are used to some extent in all the counties except Baldwin, Heard, Carroll, Haralson, Gwinnett, Walton, Union, and Habersham. Good ones are approved for light soils of smooth, stumpless, reckless, level lands. They are efficient only in skilled and careful hands, and make the rows more uniform and use less seed than in the old way. They are worthless in Carroll, where the land is rocky and rooty, and are being abandoned in Cherokee.

CENTRAL COTTON BELT: They are everywhere used, but to a very limited extent only. They are highly approved generally, but are good only on smooth, stumpless lands. In Webster and Sumter the Dowlaw planter is considered a success, and is used by the majority. In Glascock and Laurens they are reported as seed- and labor-saving, efficient and convenient, making rows easy for plowing and hoeing.

LONG-LEAF PINE AND WIRE-GRASS REGION: They are used and generally approved in all the counties heard from except Telfair, Effingham, Appling, Emanuel, and Montgomery. In Lowndes they are not approved, because trees and stumps are too numerous for their successful use. They are used almost exclusively in Brooks, and are elsewhere considered indispensable, especially on large cotton farms in Worth. They make better stands in Baker; are always approved when once properly used in Johnson.

COAST AND PINE-FLAT REGION: They are considered indispensable in Chatham; in Liberty and Clinch a few in the hands of the white man reduce the labor of planting to one-sixth of that by hand. In Pierce "according to experience, the Dowlaw planter will not work in the light soils except sometimes when packed down by rains".

16. How long usually before the seed comes up?

NORTHWEST GEORGIA: From five to seven days in Walker and Gordon; from seven to ten in Murray, Floyd, and Polk; from ten to fifteen in Catoosa, Chattooga, and Bartow; fourteen to twenty-eight in Dade.

METAMORPHIC REGION: 1 Newton, two to three days, with swollen seed and good seasons; Columbia, Henry, and Carroll, three to six, conditions being good; thirty-one counties, seven to ten days; seventeen counties, ten to fifteen days; Jackson and Crawford, fifteen to twenty. The time depends upon the nature of the land (*Clarke*). Ten days if planted late, fourteen to twenty-one if planted early (2 *Cobb*). The later the planting the quicker it comes up (*Fulton*). Depends on the weather and condition of the soil (*Troup*).

CENTRAL COTTON BELT: In Laurens, eight days in warm and fourteen in cold, wet weather; Glascock, Talbot, and Sumter, from six to fifteen days; all other counties from four to ten days.

LONG-LEAF PINE AND WIRE-GRASS REGION: 2 Screven, three days; Montgomery, four to five days, conditions being fair; Emanuel, Brooks, 2 Thomas (if the soil is moist), Dodge, and Worth, from five to eight days; Appling, three to thirty days, depending upon whether planting is followed by rain or not; in other counties from eight to ten days.

COAST AND PINE-FLAT REGION: Early planting requires longer time to come up; Chatham, seven to fourteen days, according to weather; 1 Camden, fourteen to twenty, sometimes earlier; all other counties from seven to ten days.

17. At what stage of growth do you thin out your "stand", and how far apart?

When three or four weeks old in Polk, Catoosa, Jasper, Carroll, Putnam, Talbot, Quitman, Colquitt, Dodge, Echols, and Bryan; in other counties when 3 or 4 inches high, or when the plant has from three to five leaves. The plants are "chopped out" with hoes, leaving bunches at distances of usually the hoe's width. This in Hall, Cobb, Banks, Paulding, and Rockdale counties is from 6 to 8 inches; in Polk, Douglas, Spalding, Heard, Screven, Emanuel, Montgomery, Dodge, Wilcox, Bullock, and Effingham, and coast counties, from 12 to 15 inches; in Crawford and other counties of the state, usually from 8 to 12 inches, but from 18 to 24 on rich lands. Sea-island cotton, 30 inches. "When rows are 3 feet apart the plants are thinned out to 8 inches; 3½-feet rows from 12 to 24 inches; 4-feet rows from 12 to 18 inches" (*Glascock*). A second "thinning out" removes the extra stalks from each hill, leaving two or three of the most promising.

18. Is your cotton liable to suffer from "sore-shin"?

"No", in Catoosa, Hall, Baldwin, Wilkinson, Emanuel, and Effingham; "Yes," in all other counties. But little in twenty-eight counties. "Only when the plant is wounded by instruments during cultivation" (*Bartow, Bibb, Muscogee, Burke, Baker, Lowndes, Montgomery, Appling, Coffee*, and *Liberty*); if cultivated during cool and wet spring seasons (thirty-four counties). When not thinned out (*Newton* and *Bullock*). A disease natural to the plant (*Coweta*).

19. What after-cultivation do you give, and with what implements?

NORTHWEST GEORGIA: In Murray, Bartow, and Walker "throw the dirt from both sides of the row with a twisting shovel-plow, then to the row with sweeps; then use side harrows or hoes." "First, side with a scooter or bar off with a turning shovel plow and chop out the crop to bunches with the hoe; second, side with a scooter and scrape thin to a stand; continue to use the scooter and scrape, and hoe out the weeds and grass (2 *Polk*). "Harrowing chiefly, and hoeing to keep down grass (*Dade*). Other counties cultivate with scrapes, sweeps, and hoes; the methods in practice are various".

METAMORPHIC REGION: In Clarke, Gwinnett, and Cobb, first plow out the middles with the scooter, then cultivate with shovel-plows, and finally with the sweep; the crop is usually hoed three times. In Cherokee, Rockdale, Coweta, Troup, Upson, Carroll, and Meriwether, before thinning out, plow close to the row with long, narrow plows and break out the middles with shovel-plows; the third plowing is done with sweeps. In De Kalb, Fulton, Douglas, Fayette, Henry, Haralson, and Spalding, double-footed stock plows are used first, then scrapes and hoes. In Jackson, Lincoln, and Newton, with the harrow first, scrapes afterward; sometimes shovels and scooters are used. In Hancock, Crawford, Talbot, Putnam, Columbia, Greene, Morgan, Paulding, Walton, Lincoln, and Hart, three or four very shallow plowings with the sweep and two or three hoeings. Other counties use the same implements.

CENTRAL COTTON BELT: In Laurens, Sumter, Randolph, Calhoun, and Clay, first side or bar off with a gopher plow, and after thinning out cultivate with shallow running plows or sweeps, hoeing in the meantime to keep grass down. In Burke, Richmond, Jefferson, Twiggs, Taylor, Marion, Schley, Chattahoochee, Webster, Quitman, Dougherty, and Early, shallow cultivation with sweeps and hoes. In Washington and Wilkinson, first hoeing, then shallow plowing repeated several times.

LONG-LEAF PINE AND WIRE-GRASS REGION: In Thomas "side with a small solid sweep or scooter, break out the middle with larger sweeps; three plowings". Other counties, "shallow cultivation with sweeps and hoes."

COAST AND PINE-FLAT REGION: In Bryan and Chatham "the crop is barred off, hoed and thinned, after which plows and cultivators are used". In Liberty "the sides and spaces between the plants are hoed and the sides and alleys are swept three or four times, giving a little earth each time". Other counties plow several times, and hoe as often.

20. What is the height usually attained by your cotton before blooming?

NORTHWEST GEORGIA: Murray: 24 inches. Catoosa: 24 to 30 inches. Dade: 24 to 36 inches. Walker: 12 to 18 inches. Chattooga: 18 to 24 inches. Bartow: 8 to 20 inches. Floyd: 16 to 24 inches. Polk: 5 to 15 inches. Gordon: 18 inches.

METAMORPHIC REGION: Hart and Union: 36 to 48 inches. Franklin, Heard, Madison, Meriwether, Putnam, and Upson: 10 to 18 inches. Banks, Cherokee, Elbert, Jackson, Cobb, Henry, Spalding, Crawford, and Muscogee: 18 to 36 inches. Clarke, Morgan, Columbia, McDuffie, Warren, Jasper, Baldwin, and Hancock: 4 to 10 inches. Troup: 10 to 36 inches. The remainder of the counties report from 12 to 24 inches.

CENTRAL COTTON BELT.—Richmond, Wilkinson, Talbot, Marion, Randolph, and Early: 18 to 24 inches. Burke, Jefferson, Glascock, Washington, Taylor, Stewart, Quitman, Clay, Calhoun, and Dougherty: 12 to 24 inches. Twiggs, Laurens, Macon, Schley, Chattahoochee, Webster, and Sumter: 6 to 18 inches.

LONG-LEAF PINE AND WIRE-GRASS REGION: Dooly, Thomas, Telfair, and Coffee: 24 to 36 inches. Mitchell, Lowndes, Screven, Johnson, Emanuel, Montgomery, Dodge, Wilcox, Worth, Bulloch, and Effingham: 12 to 24 inches. Baker, Colquitt, Brooks, Decatur, Appling, and Berrien: 8 to 15 inches.

COAST AND PINE-FLAT REGION: Pierce: 36 to 48 inches. Liberty: 12 to 36 inches. Chatham, Wayne, Clinch, Echols, and Camden: 12 to 30 inches.

21. When do you usually see the first blooms?

NORTHWEST GEORGIA: Polk, Bartow, Chattooga, and Floyd: June 18 to June 30. Catoosa, Dade, and Gordon: July 1. Murray and Walker: July 1 to July 10.

METAMORPHIC REGION: McDuffie: As early as May 15 to May 20. Muscogee, Upson, Newton, and Crawford: June 1 to June 5. Lincoln, Morgan, Putnam, Jasper, Fayette, Baldwin, and Harris: June 10 to June 15. Union, Hart, Cherokee, Walton, Paulding, Fulton, De Kalb, Meriwether, Bibb, and Monroe: July 1 to July 4. June 15 to June 20 the blooms are white the first day and red the next, a fact observed by but few planters (*Troup*). The extreme limit given is August 1 to August 20 in Hall county. In the remainder of the counties the date varies from June 15 to June 30.

CENTRAL COTTON BELT: Webster: Late in May and early in June, when land is fertilized. Burke, Chattahoochee, Sumter, Calhoun, Dougherty, Macon, Glascock, Jefferson, Marion, Quitman, and Early: May 30 to June 10. Richmond, Washington, Wilkinson, Twiggs, Laurens, Talbot, Taylor, Stewart, Randolph, and Clay: June 10 to June 30.

LIME-SINK AND WIRE-GRASS REGION: Lowndes and Appling: May 15 to May 31. Screven, Dooly, Mitchell, Brooks, Emanuel, Dodge, and Wilcox: June 1 to June 10. Colquitt, Baker, and Decatur: Late in May. Thomas, Johnson, Montgomery, Telfair, Worth, Berrien, Bulloch, and Effingham: June 10 to June 20. The latest is July, in Coffee county.

COAST AND PINE-FLAT REGION: Camden: Early in May. Liberty and Pierce: Late in May. Wayne: June 1. Clinch and Echols: Late in June.

22. When do the bolls first open?

NORTHWEST GEORGIA: In Walker as early as July 15. Murray, Catoosa, and Chattooga, August 15. Dade, Bartow, Floyd, and Polk, August 15 to August 31. Gordon, September 1.

METAMORPHIC REGION: In Coweta, fifty-one days from time of blooming. Troup, as early as July 1. Haralson, Carroll, Warren, Upson, and Muscogee, July 15 to August 1. Twenty counties report the date as varying from August 1 to August 15. In twenty-two counties the time varies from August 15 to September 1. The extreme limit, September 15, is reached in Hart county.

CENTRAL COTTON BELT: In Chattahoochee and Calhoun as early as June 30. Macon and Dougherty, July 15. Burke, Laurens, Taylor, Webster, Sumter, Quitman, and Randolph, July 15 to August 1. Richmond, Jefferson, Glascock, Washington, Wilkinson, Talbot, Schley, Clay, and Early, August 1 to August 15. Twiggs, Laurens, and Dooly about the 20th of August. The 21st of September is the extreme limit, and this is reported from Stewart county.

LONG-LEAF PINE AND WIRE-GRASS REGION: In Screven as early as July 15. Baker, forty days after the first blooms. Colquitt, Lowndes, Brooks, Thomas, Telfair, Appling, and Worth, July 15 to July 31. Mitchell, Decatur, Dodge, Wilcox, Bulloch, Coffee, and Berrien, August 1 to August 15. Dooly, Johnson, Emanuel, Effingham, and Montgomery, August 15 to August 31.

COAST AND PINE-FLAT REGION: In Chatham as early as July 25. Liberty, Wayne, and Camden, late in July or early in August. Pierce, Clinch, and Echols, August 1 to August 15.

23. When do you begin your first picking?

NORTHWEST GEORGIA: About August 25 in Murray; September 1 in Walker, Catoosa, and Gordon; September 10 in Chattooga, Bartow, Floyd, and Polk.

METAMORPHIC REGION: Picking begins as soon as laborers can find enough (40 to 50 pounds of seed-cotton per day) to make it profitable; the time varies with seasons and location. It may begin as early as July 20 in Troup. It begins about August 1 in Carroll, August 10 in Elbert, August 15 in Haralson and Harris, August 20 in six counties, August 25 in three counties, September 1 in eighteen counties, September 10 in five counties, September 15 in five counties, and September 20 in three counties.

CENTRAL COTTON BELT: August 1 in Taylor, Macon, and Colquitt; August 10 in Randolph; August 15 in five counties; August 20 in four counties; August 25 in three counties; September 1 in six counties; September 10 in Chattahoochee county.

LONG-LEAF PINE AND WIRE-GRASS REGION: About July 25 in Baker; August 1 in Screven, Colquitt, and Worth; August 15 in four counties; August 20 in three counties; September 1 in eleven counties.

COAST AND PINE-FLAT REGION: About August 15 in Liberty, Wayne, and Pierce; August 25 in Chatham and Bryan; September 1 in Camden; September 20 in Clinch, and October 1 in Echols.

24. How many pickings do you usually make, and when? Do you ordinarily pick all your cotton?

The greatest number of counties report three pickings, usually made as fast as the cotton has opened sufficiently. It often happens that as many as four and even five are made, especially in the middle counties of the state. Cotton is all picked in all of the counties of the state, but generally with hired help. Two hands and one mule will make more than they can gather (*Putnam*). When there remains a little, very much scattered, it does not pay to pick it (*Hancock*). Excepting that which is damaged sometimes by frost (*Coffee*).

25. At what date does picking usually close?

About November 1 in Morgan, Telfair, Appling, Liberty, and Wayne; December 1 in nineteen counties of northwest and middle Georgia; in five counties of the central cotton belt, and ten counties of the long-leaf pine and coast regions. In all other counties, from December 10 to 25. The time depends on the appearance of the first severe frost.

"Before the civil war every considerable planter kept a gin of his own. Many of these gins have now fallen into disuse, and much of the ginning is done by those who make a business of it, and whose gins are run by water- or by steam-power. Farmers who care little to encourage labor (under the share system) generally have their cotton ginned by these public gins. A steam-engine now only costs about double the price of the old-fashioned 'running gear'; then, taking into account the speed with which cotton is ginned by steam, steam is the cheaper. Some still gin their crops with the old mule-power, notwithstanding a half dozen engines are heard around them every day, ginning the crops of the neighborhood. These steam-gins separate 2,000 to 6,000 pounds of lint per day, and charge one-twentieth of seed-cotton for ginning. It is almost or quite as much work for the men and teams to haul the cotton to these gins and the seed back as it would be to gin at home" (2 *Polk*).

Steam-gins are used by the wealthier farmers, to whom others of the neighborhood haul their seed-cotton to be ginned. The usual charges are 50 cents per 100 pounds of lint, ginned and packed, or the seed from that lint. This practice, both in this and surrounding counties, was made necessary by the great increase of small farms (*Clarke*). There are in this county about 30 public gins, run by steam- and horse-power, which gin at least one-half the cotton of the county at 40 cents per 100 pounds of lint ginned and packed. Steam-, water-, and horse-powers are used in all of the counties (*Washington*).

29. How much seed-cotton on an average is required for a 475-pound bale of lint?

The amount varies from 1,425 to 1,780 pounds. This difference is due largely to the fact that the time that elapses between picking and ginning is not the same. When ginned immediately the seeds are green and heavy, and more is necessarily required for the same amount of lint than if allowed to dry. Other causes also, such as variety of seed and the character of the land, have their effect upon the weight. The rule generally is that "seed-cotton will third itself in lint". Forty-one counties report 1,425 pounds; twenty counties, 1,485; fifteen counties, 1,545; the highest, 1.900 pounds, is reported from Randolph.

30. What press do you use for baling, and what is its capacity?

There are presses of thirty-seven different patents or names mentioned in the county reports, while in most of the counties the old-style wooden screw is still in use to some extent. The following is a list of the patented presses and the capacity of each, as reported:

Scofield's in twenty counties; with 4 men and 1 horse, or 7 men, it will press 15 bales per day; with 2 boys, 8 bales; with 6 men and 2 horses, 20 bales of 600 pounds each.

Brooks' in eighteen counties; with 3 men and 1 horse, 12 to 20 bales.

Winship's in eleven counties; with 2 men and water-power, 20 bales.

Smith's in seven counties; with 4 men, 15 bales.

Findley's in seven counties; by water-power, 12 to 15 bales, or with 4 men, 20 bales.

Allum's in seven counties; with 4 men and 2 mules, 20 bales.

Wright's in seven counties; Utley's, Cole's, and Atkinson's in four each; Van Winkle's and Nesbit's in three each; Stokes' and Bullock's in two each; and the following in one county each: Dixie, Ingersoll, Grange, Southern Standard, Pendleton, Boardman, Wilson, Taylor, Athens, Poor Man's, Griffin, Craig, Hines, Packard, Neal, Eclipse, Helm's, Bankman's, Templeton, Atkinson, Roundtree, Bloodworth, and Gleason. All have about the same capacity.

31. Do you use rope or iron ties for baling; if the latter, what fastening do you prefer?

Iron ties are used exclusively everywhere throughout the state except where sea-island cotton is produced, which is simply put in bags. The "arrow fastening" is generally preferred, though there are various other fastenings in use in all of the counties, and fifteen correspondents claim that "all are equally good". Correspondents from nine counties prefer the hook variety. The Dunn, in Glascock; Harper, in Putnam; and Hayden, in Chattooga.

32. What kind of bagging is used in your region?

Gunny is reported by 39 correspondents, hemp by 32, jute by 20, "all kinds" by 6, Anchor brands by 5, Dixie brand by 4, the best obtainable by 4, common bagging by 2, manila by 2, Greenleaf bagging by 1, and New Orleans bagging by 1.

Bagging of 2 or 2¼ pounds' weight by seven counties. The best and heaviest seem to be preferred, as necessary to endure the rough handling with hooks to which bales are subjected during transportation.

33. What weight do you aim to give your bales? Have transportation companies imposed any conditions in this respect?

Five hundred and fifty pounds is reported from Bibb. Three correspondents report 525 pounds; seventy-six report 500 pounds; sixteen report 475 pounds; thirty-three report 450 pounds; two report 400 pounds. Sea-island lint is put up in bags of 250 to 350 pounds each in Camden and other coast counties. Twenty-two counties report that "no conditions are imposed except by cotton buyers. These fix the minimum weight per bale and deduct $1 to $2 from the market value of each bale below". Two report the minimum to be 250 pounds; twelve report 300 pounds; one reports 310 pounds; four report 350 pounds, and five report 400 pounds. "Competition of buyers has abolished this condition" (*Polk*). "Railroad companies charge per 100 pounds for carrying; river carriers charge per bale regardless of weight. In either case, if cotton is lost in transit or by fire at destination or elsewhere, it is paid for by carriers and insurance companies at the rate of 450 pounds per bale" (*Laurens*). Since all expenses are per bale, the aggregate is comparatively less on heavy than on light bales (*Clinch*).

DISEASES, INSECT ENEMIES, ETC.

34. By what accidents of weather, diseases, or insect pests is your cotton crop most liable to be injured? At what dates do these several pests or diseases usually make their appearance, and to what cause is the trouble attributed by your farmers?

NORTHWEST GEORGIA: The caterpillar and boll-worm are reported from all the counties except Murray and Catoosa, appearing, however, rarely in Walker, Dade, Chattooga, Floyd and Polk. The time of their coming varies from August to October. The army-worm is reported from Walker. It sometimes injures the crops, but when it appears late in the season it is by some believed to benefit the crop by hastening the opening of the bolls. Aphides (plant lice) and fleas, in May and June, are of common occurrence in Walker and Bartow, and are attributed to cool nights in the spring. The cut-worm is reported from Polk, appearing in May and June. Rust, shedding, and rot of bolls in summer and early fall are prevalent in all the

counties excepting Murray and Catoosa, owing to too much rain, very dry seasons following excessively wet ones, and sudden changes of weather. Rust occurs in Polk, generally on fresh or very old lands, and is attributed to a very small louse or mite.

METAMORPHIC REGION: The caterpillar and boll-worm appear in the following counties: Habersham, Cherokee, Oglethorpe, Wilkes, Douglas, Newton, Taliaferro, McDuffie, Jasper, Coweta, Heard, Troup, Upson, Crawford, and Muscogee. The caterpillar alone is reported from Baldwin, Harris, and Hancock, and appears to some extent in Forsyth. The boll-worm alone in Clarke, Walton, Fulton, De Kalb, Columbia, and in Putnam to a slight extent. Aphides are of common occurrence in Cherokee, Lincoln, Douglas, and Fulton; none reported in the remainder of the counties. The cut-worm appears only in Warren and Crawford as far as reported. No pests of any kind are reported in Hall county. Rust and shedding are of common occurrence in almost every county of this region, caused by extreme states of the weather, either wet or dry, and by warm dry seasons following very wet ones.

CENTRAL COTTON BELT: The caterpillar is reported in all of the counties except Richmond, Wilkinson, Johnson, and Emanuel, appearing usually in August or September; the boll-worm in all of the counties except Richmond, Wilkinson, Twiggs, Laurens, Macon, and Randolph. The cut-worm appears in only Richmond and Burke as far as reported, and aphides in Laurens, Schley, Chattahoochee, and Quitman. Other diseases are prevalent in all of the counties, and are attributed generally to extreme conditions of weather; rot of bolls usually to "wet weather, when the foliage of the plant is dense".

LONG-LEAF PINE AND COAST COUNTIES: The caterpillar is reported from all of the counties except Johnson and Emanuel, appearing, however, rarely in Screven and Clinch. It usually comes in August or September; in Coffee county "so late as to do but little damage". The boll-worm is reported by but 15 counties, and in Dodge "is not known at all". Shedding and rust, as well as rot of bolls, are common to nearly all of the counties, and are attributed mostly to extremes of weather or to sudden changes from one extreme to another. "Rot of bolls appears in wet weather only when the plants stand too thick in the row. When the root strikes the poorer subsoil and the side roots have exhausted the surface soil rust is apt to appear, and may be induced either by drought or by other cause. An abundant supply of manure to the surface and subsoil will prevent rust, but the remedy is impracticable on the large scale" (1 *Screven*). "Twelve or fifteen years ago the caterpillar appeared in the cotton-fields only once in two, three, or sometimes four years; but later its ravages have increased, and it seems to be a fixture, coming now regularly each year and apparently defying all efforts to check it. The farmers regard it with dread, for when it makes its appearance earlier than usual, as is sometimes the case, it does much damage, especially to late cotton. As a rule, the farmers try to push their cotton by manuring and using early varieties of seed, that the crop may mature as far as possible before the caterpillar arrives" (*Decatur*).

35. What efforts have been made to obviate the trouble, and with what success?

No special efforts are reported in the greatest number of counties. The following have been made with some degree of success: "Deep plowing" in Chattooga, Polk, Putnam, Newton, Baldwin, Gwinnett, Dooly, Worth, and Berrien against shedding, rust, etc.; continued surface cultivation in Lincoln and Baker; fertilizers and drainage to prevent rust in McDuffie, Monroe, Taylor, Early, Talbot, and Marion; "the use of wood ashes" (2 *Lincoln* and *Paulding*); "rotation of crops (1 *Douglas*); the application of salt for rust (*Carroll* and 1 *Putnam*); but this meets with poor success in Wilkinson, Webster, and Sumter. For the destruction of insects and moths lamp- and water-traps have been used in Webster and Thomas, but with uncertain success. "A water-furrow is left between rows after the final cultivation. The soil is not stirred when wet, otherwise rust and blight surely follow. This is sometimes apparent when parts of the same field are treated in these two different ways" (2 *Liberty*). "The prohibition of the indiscriminate slaughter of insectiverous birds is of more economic importance and practical utility than all the chemical insect poisons combined" (1 *Webster*).

36. Is rust or blight prevalent chiefly on heavy or ill-drained soils? Do they prevail chiefly in wet or dry, cool or hot seasons, and on which soil described by you?

On both heavy and ill-drained soils, in all of the counties throughout the state. That they prevail chiefly in extreme conditions of the weather is reported by six counties; in wet seasons, forty-five counties; dry seasons, seven counties; cool weather, eighteen counties; hot weather, twenty counties, where hot and dry follows excessive wet seasons. On sandy lands, twenty-four counties of the northwest and metamorphic regions, and nearly all of those of southern Georgia. Other counties report the prevalence of these diseases on all lands. "Those spots that suffer most from rust in wet periods are the same that suffered most from drought in the period preceding" (1 *Polk*). "Rust is rarely seen on red clay lands" (*Lincoln*, *Troup*, and *McDuffie*). "Most common when outcroppings of impervious clays occur" (*Monroe*). "In the flats of piny woods and sweet-gum bottoms" (*Warren*). "On the small black prairies" (*Twiggs*). "Old lands seem to suffer most" (*Richmond*, *Marion*, *Webster*, *Dooly*, and *Clinch*). "The black or humid rust prevails chiefly in the flats and pipe-clay lands. Manure is put deep in furrows on such lands, and when the plant roots become submerged during rains the bolls turn black and drop off. Other rusts appear on sandy and old soils" (*Richmond*). "Red rust is most common in dry weather; black rust, the worst of the two, in wet seasons" (*Lowndes*).

37. Is Paris green used as a remedy against the caterpillar? If so, how, and with what effect?

It has been used only in the counties of McDuffie, Putnam, Harris, Talbot, Muscogee, Burke, Schley, Stewart, Webster, Quitman, Calhoun, Dougherty, Baker, Mitchell, Brooks, Thomas, Screven, Dodge, Worth, and Effingham, and, owing to its expense, the danger attending it to men and animals, as well as to its but partial success in destroying the caterpillar, it has been very generally abandoned. It is usually applied to the plant in solution by means of a sprinkling pot. "In the form of powder, mixed with flour and resin, with fair success; but it is too expensive for most planters. A less efficacious but cheaper poison than Paris green or London purple is a solution of one pound of arsenic in a barrel of water. This is applied by sprinkling pots, or, better, by 'fountain pumps.' This is the cheapest and most easily applied poison for the purpose, and it destroys the caterpillar for ten to fifteen days, or until the poison disappears from the plant, when the application must be renewed if the pest continues. Planters who have used poisons with care and judgment are pleased with the results. Many try them when too late, or they leave the application to careless and unintelligent laborers, and the results are not good" (*Dougherty*).

LABOR AND SYSTEM OF FARMING.

38. What is the average size of farms?

From 150 to 200 acres (or sometimes 300) in northwest Georgia; from 20 to 100 acres in the Blue Ridge region; from 50 to 200 acres in the northern counties, and from 200 to 500 acres in the southern counties of middle Georgia, and sometimes as much as from 1,000 to 2,000 in Cherokee, McDuffie, and Troup; from 50 to 150 or sometimes 200 acres in the central cotton belt and the long-leaf pine region, and from 50 to 100 acres in the coast counties.

39. Is the prevalent practice "mixed farming" or planting? Are supplies raised at home or imported? If the latter, where from? Is the tendency toward raising home supplies increasing or decreasing?

"Planting" is the prevalent practice in Morgan, Greene, Bibb, Muscogee, Hancock, Quitman, and Decatur counties. In all the rest of the state "mixed farming" prevails. The counties which raise their own supplies are Murray, Catoosa, Dade, Gordon, Fannin, Union, Hart, Marion, Dooly, Mitchell, Colquitt, Brooks, Dodge, Telfair, Coffee, Berrien, Bulloch, Tatnall, Effingham, Pierce, and Echols. In 75 counties most of the supplies are produced at home, some of the bacon and flour being brought from the northwestern states. Other counties obtain the greater part of corn, flour, and meat from Saint Louis, Chicago, Louisville, and Cincinnati. The tendency toward home supplies is decreasing in Walker ("because the cotton area is increasing"), Chattooga, Gordon, Forsyth, Haralson, Greene, Troup, and Effingham; is unvarying in Bartow, Polk, Cherokee, Elbert, Cobb, De Kalb, Coweta, Jefferson, Glascock, and Emanuel, and is increasing in all other counties. "Raising of home supplies varies inversely as the price of cotton" (*Laurens*).

40. Who are your laborers chiefly? How and when are their wages payable?

NORTHWEST GEORGIA: Native whites and negroes. Wages are 50 cents per day, $8 to $10 per month with board, or $12 to $14 without board, or $100 to $150 per year, payable, according to contract, as they require it, or at the end of the season.

METAMORPHIC REGION: In Fannin, Europeans, chiefly English and Irish; towns, 98 per cent. white. Jackson, 1 per cent. Chinese. Mostly whites in Union, Habersham, Hart, Banks, Hall, Forsyth, Gwinnett, Cobb, Paulding, Haralson, and Heard; whites and negroes in Madison, Carroll, Rockdale, Taliaferro, Spalding, and Meriwether; mostly negroes in the other thirty-three counties. In eighteen counties wages paid are from $75 to $90 per year, or $6 to $8 per month. In other counties the average is about $100 per year, or $8 to $10 per month, in all cases with board. In Fulton $100 is paid with board, or $130 to $140 without board. Day laborers receive from 40 to 75 cents per day, and are paid weekly or daily, the latter during the busy season of the year. Payments are made according to contract, or when the laborer needs the money, final settlements being made at the end of the year when crops are sold.

CENTRAL COTTON BELT—LONG-LEAF PINE AND COAST REGIONS.—Except in Glascock, Colquitt, and Berrien counties the laborers are chiefly negroes. The men receive from $5 to $10 per month or $60 to $100 per year; the women from $4 to $6 per month or $40 to $60 per year. Day laborers are paid usually 50 cents per day. Board is also furnished with the above wages, which are paid, according to contract, usually at the end of the year. "They have the free use of land, team, and implements on Saturday (a day they claim and will have) for raising crops of their own" (*Twiggs*).

41. Are cotton farms worked on shares, and on what terms? Are supplies furnished by the owners?

The share system is practiced in all of the counties of the state to a greater or less extent, except in Dade and Union on the north, and Colquitt, Berrien, Chatham, Bryan, Wayne, and Pierce on the south.

The owner receives one-fourth the cotton and one-third of the corn for use of land alone, or one-half the crop for the use of land, implements, and teams, the laborer boarding himself. If board is also furnished, the owner receives two-thirds of the crop. In northwest Georgia, if the laborer leases new land, he takes off all timber of less than one foot diameter, incloses the land with a good ten-rail fence, and has the use of it for three years, or, if bottom land, for four years. In some counties of middle Georgia the cost of fertilizers, ginning, and baling is shared equally. In some cases tenants pay two 500-pound bales, delivered in Augusta, for the use of as much land as they can cultivate with one horse or mule; such tenants have their own plow teams, cattle, and hogs, sell their own produce, do their own trading, and disburse their own funds (*Columbia*). Labor is considered equivalent to one-third of the crop, land to one-third, and the stock, feed, and implements to one-third (*Appling*).

42. Does your system of labor give satisfaction? How does it affect the staple, and does the soil deteriorate or improve under it?

NORTHWEST GEORGIA: The system of shares very generally gives satisfaction in all of the counties, except Gordon, where "laborers are not reliable". The staple is not materially affected, except in Chattooga, Walker, and Bartow, where it is claimed to be "freer from trash than when picked by hired labor". In all but Murray, Catoosa, and Bartow, the share system is said to injure the soil.

METAMORPHIC REGION: Not entire satisfaction in Fannin, Franklin, Madison, Oglethorpe, Wilkes, Lincoln, Fulton, Morgan, Taliaferro, Columbia, Putnam, Jasper, Spalding, Coweta, Heard, Upson, Talbot, Crawford, Bibb, Muscogee, and Hancock. "To the tenant and not to the owner" (*Gwinnett, Haralson, Cobb,* and *Warren*). Very general satisfaction in other counties. "It is not as satisfactory to the owner as the wages and renting system" (*Lincoln, Haralson,* and *Upson*). It is generally thought that the staple is not affected, except in Wilkes, Lincoln, Walton, Troup, Baldwin, Talbot, Crawford, and Hancock, where it is claimed that the cotton is trashy because of careless picking. Some counties claim a better grade than where picked by hired labor. "The quality is observed to depend to some extent upon the intelligence of the labor by which it is produced" (*Columbia*). The soil improves under the system (*Hart,* 2 *Cherokee, Oglethorpe, Gwinnett,* 1 *Warren,* and *Fayette*). In all other counties it is said to deteriorate. "The plan of dividing crops under the share system is an equitable one, and if it were properly carried out there could be no cause for complaint; but the owner, in nine cases out of ten, has not only to furnish his farm, but to supply all the needs of the tenant, without having any control over the time or acts of the tenant, who is often seen idling and loitering when his crop requires his immediate attention. Tenants owe the owners for provisions, clothing, tobacco, etc., and in many cases they are indifferent as to whether they produce enough to pay the owners these advances made during the season. Thus the landlords annually lose largely by this system of shares, simply because they have all the risks and no corresponding control" (*DeKalb*).

CENTRAL COTTON BELT: Yes; in all counties except Burke, Glascock, Laurens, Schley, Stewart, Webster, Clay, and Calhoun. A few report an inferior staple because of trash and careless

Rent here is about 30 pounds of lint per acre; this amounts to about $2. Rails are used exclusively for fencing, old-field pine rails, when split and "put up", costing 55 to 65 cents per hundred; of oak or other good timber, 60 to 75 cents per hundred. The pine rails last two years; oak will last eight or ten years. It costs $5 per acre to fence a 50-acre field with pine rails for ten years, or about $3 with oak rails; but as the fencing is never done as it should be, the actual costs are about $2 to $2 50 with pine, or $1 with oak per acre, yearly, on 50-acre fields.

When stubble is very heavy it is sometimes burned in dry weather, and rubbish is sometimes cleared from fresh fields; otherwise stalks and stubble are generally plowed under. But in any case a high average rate per acre for all such clearing off would be 50 cents.

In preparing cotton land, my own operations consist in first locating the beds by laying off furrows 4 feet apart with a shovel-plow as deep as it can be done. Into these furrows I put another with a bull-tongue plow. I next put a small turning-plow on each side of this with the same bull-tongue plow, and then bed out the rows with a larger turning-plow. The land is then ready for planting.

Two plows can bed up 1½ acres per day. The hire of hands per day is 30 cents, their board 25 cents, and the horses 30 cents per day; cost of gear and wear and tear will make the day's plowing worth about $1. The two will plow, in stubble land, 1½ acres, making the whole cost about 75 cents per acre for the plowing in the preparation of an acre for planting.

Manuring.—It is the common practice here to open the top of the bed with two furrows, one in the other, then with a tin tube 3½ feet long, having a funnel-shaped mouth, distribute about one hundred pounds of commercial fertilizers to the acre. This can be done by one hand at the rate of an acre per hour. A great many, instead of opening the middle of the bed, put their fertilizers in the water furrow and rebed back. My plan is to put the fertilizers in at the first bedding up; if it is cotton-seed or stable manure, to bed upon it, and open and plant afterward; if it be a commercial fertilizer, I frequently put it in with the seed and cover both with a block or double-footed plow, and board it off afterward if the ground is rough.

The whole process with commercial fertilizer will require three hours with horse and plow and one hour with the horn, or the same time to distribute cotton-seed to each acre manured; but where stable manure or compost is used it will require four hours to distribute it over an acre as it should be. The cost of applying commercial fertilizers or cotton-seed per acre is 50 cents; of home-made manure, 75 cents.

The usual cost of planting is 25 cents per acre; it costs me 35 cents. I use a double-footed plow first with a board or harrow behind. I usually plant cotton on stubble land and exercise great care to obtain a stand. I never replant cotton, and it is rarely done in this locality. If the stand is insufficient, farmers prefer to plow up and plant again even as late as May 15. In after-cultivation, a plow will cultivate three acres per day of rows three feet apart, or four acres of rows four feet apart. The day's plowing being worth 75 cents, the cost per acre is 25 cents for 3-foot rows, or about 20 cents for 4-foot rows.

Cotton should always have four plowings if it takes till the middle of August. In very wet seasons the cost of cultivation is doubled and the turning-plow is used exclusively. Hoeing is the most expensive part of cotton culture, especially in wet or even in average seasons. The first use of the hoe consists in chopping out the row of young cotton to bunches of from two to six plants. A good hand can chop out an acre a day; this is worth 50 cents. The next hoeing is to bring cotton to a stand; this requires one and one-half days, and costs 75 cents. The next hoeing is comparatively easy if the weather is not rainy, and costs about 30 cents. The second, or June, hoeing is much the most tedious and costly if wet weather prevail. A first-rate hand may only hoe a quarter of an acre per day with hard work, and leave a bad stand. In a favorable season the hoeing amounts to $1 55 per acre, or twice as much in a wet season.

For picking, hands receive 30 cents per 100 pounds of seed-cotton and their board, or 45 cents without board. The so-called outside hands do more than half the picking. That picked by the regular hands costs about 20 cents per 100 pounds; the average cost of picking is therefore about 25 cents per 100 pounds, or $2 per acre of 800 pounds.

Very little seed-cotton is hauled to gins except by a few small farmers. The cost of ginning an acre of seed-cotton (800 pounds) is about $1; steam gins do it for less, but in that case occurs the expense of hauling to them. The costs of wear and tear of gin and press amount at least to 25 cents per 800 pounds; this makes the cost of ginning an acre $1 25.

MONROE COUNTY: Stalks, etc., are plowed under. The estimates are based upon a good season for crops; some of them are too low when there is much rain in the spring.

MUSCOGEE COUNTY: The estimates are based upon a yield of 600 pounds of seed-cotton per acre.

1 SCREVEN COUNTY: The estimates assume a yield of 600 pounds per acre, and that the land produced cotton the preceding season.

In this section pulling and burning stalks, bedding up with hoes (a good practice), and harrowing before planting are not usually practiced. The after-cultivation consists of four plowings and three hoeings, each estimated at 50 cents per acre. The estimates are based upon reasonable and ordinary rates; and in many instances, even in this section, much more work is done than is above accounted for, both in the preparation and in the subsequent cultivation of cotton land. The seed is sometimes given for ginning.

TROUP COUNTY: Lands cannot be made too rich for cotton. Prepare them well, keep the manure as near the surface as possible, plant shallow, do not plant too thick, cultivate fast and shallow, and if a growth of 2 feet is obtained by July 15 a good crop is assured if the seasons are favorable (*J. F. Jones*).

COST OF PICKING.

Cotton picking season is a noted time among the rural population, but especially among the idlers around the towns. "Two hands and one mule can make more than they can pick", and but for extra labor much of the crop would probably remain in the fields. The price paid for picking varies but little throughout the state, as will be seen from the following answers:

J. H. DUNCAN, *Elbert county;* J. B. ROBERTS, *Washington county;* J. H. DANIEL, *Burke county;* S. M. GRIFFIN, *Brooks county;* and S. C. PRUDDEN, *Putnam county:* The price paid for picking cotton is from 40 to 50 cents per 100 pounds of seed-cotton, with board, or 75 cents without, for day laborers.

F. H. NICHOLS, *Forsyth county:* It is customary to pay 50 cents per 100 pounds. The picking is usually weighed every night and laborers paid in money. In some instances the producer pays as high as 75 cents, the laborer boarding himself; but this depends upon the condition, stand, and other items dependent upon gathering the crop at the time.

R. F. MILLER, *Coweta county:* When cotton begins to open laborers are paid 40 cents per 100 pounds. As the season advances more is paid. When a field is all open, and danger from rain storms apprehended, as high as 75 cents per 100 pounds is paid. Fifty cents per 100 is the average price, and the picker feeds himself. Very few will work by the day picking cotton. A sorry hand will demand as much as a good one, and an expert can make from $1 25 to $2 per day in a good field when picking by the 100 pounds.

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REPORT

ON THE

COTTON PRODUCTION OF THE STATE OF SOUTH CAROLINA,

WITH A DISCUSSION OF

THE GENERAL AGRICULTURAL FEATURES OF THE STATE.

BY

HARRY HAMMOND,

SPECIAL AGENT.

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LETTERS OF TRANSMITTAL.

BERKELEY, CALIFORNIA, *September* 26, 1882.

To the SUPERINTENDENT OF CENSUS.

DEAR SIR: I transmit herewith a report on the cotton production and agricultural features of the state of South Carolina, by Harry Hammond, esq., of Beech Island, South Carolina, special agent of the census.

Mr. Hammond's report differs somewhat in plan and tenor from those that have been made of other states, in the especial attention bestowed by him upon the historic, statistical, economic, and commercial sides of the subject of cotton production, as well as of general agriculture, which are treated with great fullness and ability, thus forming a valuable contribution to the industrial history not only of South Carolina, but of the Atlantic cotton states generally.

While the general descriptions of the agricultural regions are as full and graphic as could be desired, I have to regret the omission of the descriptions of individual counties, with abstracts of answered schedules, that form Part II of the reports on the other cotton states, and are especially designed to furnish, in compact and convenient form, the information usually desired by immigrants. Mr. Hammond desired to substitute therefor the descriptions of individual townships, as abstracted from answered schedules and from reports made to the commissioner of agriculture of the state. But as these townships are units unknown to all but the most special state maps, such substitution does not appear to me to convey information of a character sufficiently definite to justify their publication in this work, the more as not nearly all the townships of each county were thus represented.

Very respectfully,

E. W. HILGARD,
Special Agent in charge of Cotton Production.

BEECH ISLAND, SOUTH CAROLINA, *May* 25, 1882.

Professor EUGENE W. HILGARD,

Special Agent in charge of Cotton Production, Berkeley, California.

DEAR SIR: I inclose herewith the report of cotton culture in South Carolina. The report embraces a sketch of the geography of the state, and its division into seven agricultural regions. These regions are distinguished by the diversity of their physical and geological features, their forest growth, climate, soils, difference of elevation above the sea-level, and to a large extent by the pursuits of the inhabitants.

In addition to the information furnished by the Census Office, or derived from personal travel under its auspices, this compilation includes—

1. Answers to schedules of questions touching soils and details of cotton culture, issued by you through the Census Office.

2. Answers to circulars sent by A. P. Butler, commissioner of agriculture of South Carolina, to each township in the state, touching its soils and resources.

3. Besides numerous pamphlets and reports on the earlier explorations of Carolina, valuable information has been obtained from the following publications: *Proceedings of the State Agricultural Society*, 4 volumes; *Mills' Statistics of South Carolina*, 1826; *Report of the Agricultural Survey of South Carolina*, by Edmund Ruffin, 1843; *Report of the Agricultural and Geological Survey of South Carolina*, by M. Tuomey, 1844; *Geology of South Carolina*, by M. Tuomey, 1849; and *Reports on the Geognostic Survey of South Carolina*, by O. M. Lieber, 4 volumes, 1856–'59.

Although no material change has been made in the boundary lines of the state since the surveys of 1764 and 1772, its area has been variously estimated on different occasions; in 1802 Governor Drayton estimates it at 24,080 square miles; in 1826 Mills makes it 30,213 square miles; in 1870 the estimate of the Ninth Census, based on the topographical sheets of the Coast Survey of 1865, places it at 34,000 square miles; the estimate of the Tenth Census, published some time after this report was commenced, places it at 30,570 square miles.

Cotton culture in South Carolina so much predominates over other pursuits, and monopolizes to so large an extent the resources of the state, that a full account of it would amount almost to a full account of the entire industrial and economic relations of the state. The valuation of the total real and personal property in the census year was something over $120,000,000, as shown on the books of the comptroller-general; the cotton crop of that year sold for at least $25,000,000, and this was about 60 per cent. of the value of all the agricultural productions of that year throughout the state. The attempt, and especially a first attempt, to portray concisely such an industry can only claim to be an approximation to correctness; it is to be hoped that the omissions, deficiencies, and inaccuracies in the accompanying report will not mislead in the preparation of more accurate accounts which the subject merits, and which will be given of it doubtless in the not remote future.

The pivotal questions affecting the prosperity and profitableness of agricultural pursuits in South Carolina are, as elsewhere, the fundamental ones relating to labor and land. Loosened, as agriculture in this state is, from all ancient moorings on these points, nowhere are more earnest and varied experiments being made as to the methods of organizing and co-regulating these factors of wealth. The remarkable advances made in material prosperity, as shown by this report, in the decade from 1870 to 1880, encourage the hope that a nearer approach to a correct system in these regards is being made.

Very respectfully,

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HARRY HAMMOND.

TABULATED RESULTS OF THE ENUMERATION.

TABLE I.—AREA, POPULATION, TILLED LAND, AND COTTON PRODUCTION.
TABLE II.—ACREAGE AND PRODUCTION OF LEADING CROPS.

TABLE II.—ACREAGE AND PRODUCTION OF THE LEADING CROPS.

Counties.	COTTON.		INDIAN CORN.		OATS.		WHEAT.		SWEET POTATOES.		RICE.	
	Acres.	Bales.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Pounds.
The State	1,364,249	522,543	1,363,404	11,767,099	261,445	2,715,505	170,902	962,358	39,059	2,189,622	78,288	52,077,515
Abbeville	33,538	26,380	51,569	471,955	23,544	249,981	14,396	107,608	474	31,123	16	8,965
Aiken	37,018	14,334	51,481	377,922	3,545	54,339	6,527	22,584	1,064	31,895	643	490,012
Anderson	61,060	21,897	49,958	492,646	12,776	94,613	16,754	101,950	526	36,550	53	33,257
Barnwell	33,468	28,764	34,108	607,610	10,968	140,156	3,778	18,057	1,787	102,649	1,388	742,688
Beaufort	11,570	2,740	14,735	135,755	213	2,901	.....	.....	4,323	160,980	12,763	10,599,661
Charleston	24,802	9,308	29,569	279,968	1,773	23,996	16	196	3,821	170,584	12,085	8,963,196
Chester	52,324	19,051	40,469	357,308	10,440	87,583	7,342	35,768	103	7,005	.....	.....
Chesterfield	18,480	7,733	27,228	247,430	4,640	41,646	2,549	10,320	938	27,199	14	5,155
Clarendon	26,687	8,589	32,810	222,274	2,345	28,777	125	624	1,237	59,196	1,828	691,257
Colleton	11,447	4,869	43,544	376,532	5,931	66,097	186	805	1,738	117,825	16,057	11,136,056
Darlington	60,404	23,946	53,557	440,892	8,317	88,216	2,593	13,453	1,917	116,096	1,090	453,764
Edgefield	93,797	35,894	67,825	559,086	36,432	415,243	11,323	67,841	1,085	70,756	3	660
Fairfield	69,807	25,729	40,274	367,930	7,561	86,566	4,012	24,511	934	53,855	5	3,620
Georgetown	362	160	4,389	44,161	205	3,741	.....	.....	590	49,674	11,665	10,627,889
Greenville	45,572	17,064	52,599	582,156	9,282	62,673	11,605	62,132	448	34,132	22	13,792
Hampton	21,624	7,711	30,325	227,884	5,325	58,595	23	147	827	84,250	3,083	1,407,280
Horry	1,773	809	13,391	163,895	157	1,057	.....	.....	2,177	155,886	1,781	747,689
Kershaw	28,978	11,289	21,891	219,957	2,849	34,402	1,569	6,355	772	39,802	529	126,483
Lancaster	30,744	12,677	26,622	294,939	6,697	48,385	3,777	16,852	247	14,117	.....	.....
Laurens	63,956	24,484	45,066	381,933	15,860	149,419	9,864	62,243	369	24,207	1	720
Lexington	22,871	9,050	35,760	304,569	10,237	121,290	12,155	48,167	1,671	62,557	233	128,618
Marion	45,520	21,748	55,183	470,745	6,784	69,011	1,081	9,131	2,928	187,103	3,149	1,628,073
Marlborough	41,251	23,785	33,773	338,527	4,727	63,180	2,436	20,077	1,115	61,416	126	39,064
Newberry	57,447	24,155	34,905	315,863	13,994	177,962	9,258	64,136	513	38,437	.....	.....
Oconee	18,595	8,818	23,224	268,899	4,527	39,392	4,265	26,017	171	11,331	12	3,945
Orangeburgh	61,354	24,452	66,419	529,259	9,727	140,473	3,529	15,635	1,176	65,674	6,245	2,052,249
Pickens	18,463	5,756	27,070	314,064	2,882	23,987	4,994	31,663	251	20,068	28	39,460
Richland	28,343	10,958	19,431	171,040	2,158	30,904	514	3,916	726	39,816	233	164,121
Spartanburgh	61,337	24,188	56,225	593,454	11,287	74,572	14,808	79,991	340	22,168	5	3,356
Sumter	57,958	22,469	51,876	442,360	5,886	64,581	460	2,644	2,191	96,396	1,952	669,592
Union	54,260	19,605	36,710	379,330	5,562	42,040	6,710	33,951	329	21,396	.....	.....
Williamsburgh	15,886	5,627	30,291	230,311	1,070	9,360	78	409	1,773	91,414	3,428	1,459,419
York	58,546	23,523	51,532	636,505	12,834	119,832	14,175	75,173	543	34,156	1	640

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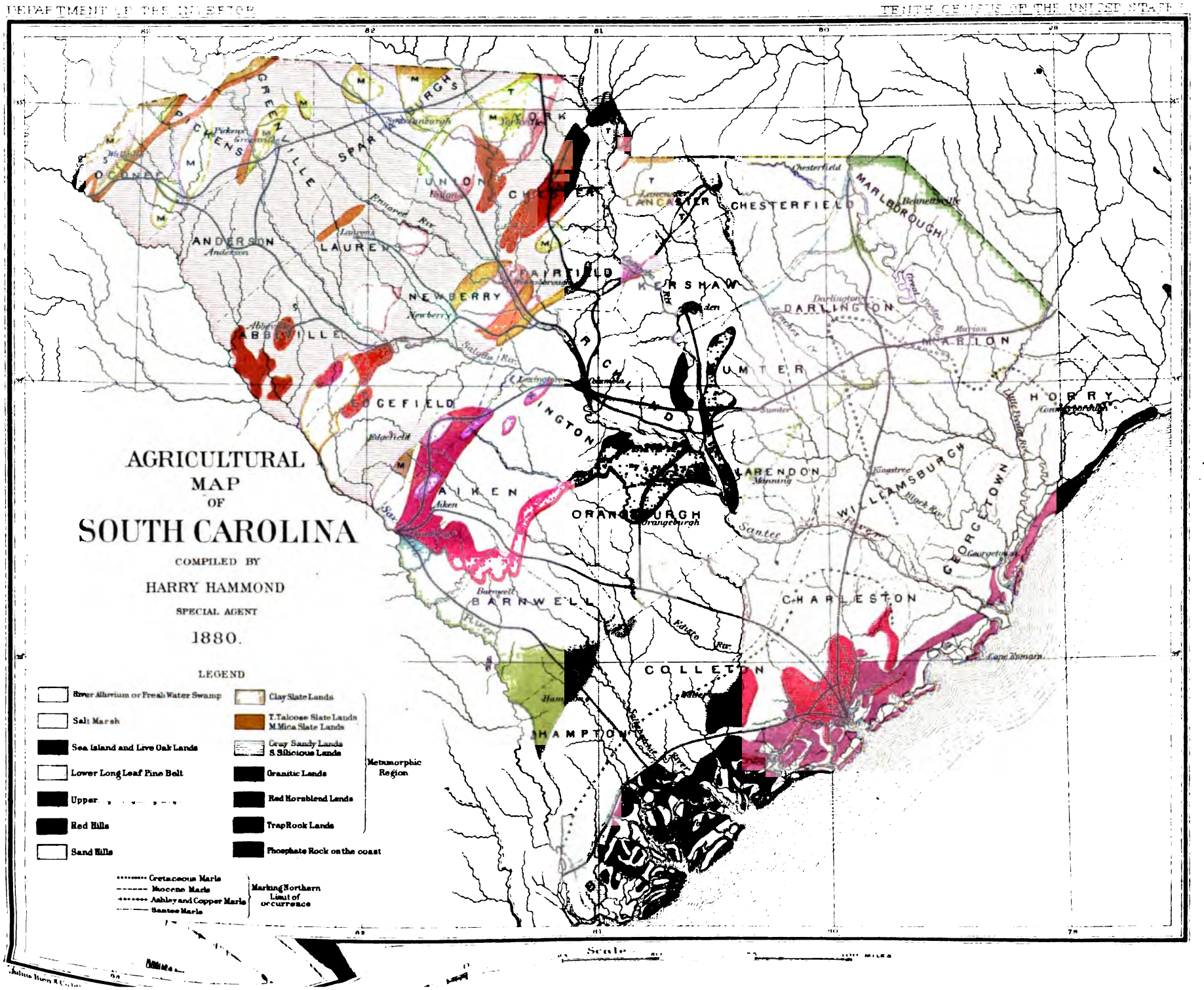
PHYSICO-GEOGRAPHICAL AND AGRICULTURAL FEATURES

OF THE

STATE OF SOUTH CAROLINA.


AGRICULTURAL
MAP
OF
SOUTH CAROLINA
COMPILED BY
HARRY HAMMOND
SPECIAL AGENT
1880.
LEGEND
River Alluvium or Fresh Water Swamp
Salt Marsh
Sea Island and Live Oak Lands
Lower Long Leaf Pine Belt
Upper
Red Hills
Sand Hills
Clay Slate Lands
T. Talcose Slate Lands
M. Mica Slate Lands
Gray Sandy Lands
S. Siliceous Lands
Granitic Lands
Red Hornblend Lands
Trap Rock Lands
Phosphate Rock on the coast
Metamorphic Region
Cretaceous Marls
Miocene Marls
Ashley and Copper Marls
Santee Marls
Marking Northern Limit of occurrence
Scale
ANDERSON
PICKENS
GREENVILLE
SPARTANBURGH
UNION
CHEROKEE
YORK
LANCASTER
CHESTERFIELD
MARLBOROUGH
LAURENS
NEWBERRY
FAIRFIELD
KERSHAW
DARLINGTON
MARION
ABBEVILLE
EDGEFIELD
RICHLAND
SUMTER
HORRY
LEXINGTON
AIKEN
CLARENDON
ORANGEBURGH
WILLIAMSBURGH
GEORGETOWN
BARNWELL
CHARLESTON
COLLETON
HAMPTON

OUTLINE OF THE PHYSICAL AND AGRICULTURAL FEATURES

OF THE

STATE OF SOUTH CAROLINA.

The state of South Carolina lies between north latitude 32° 4′ 30″ and 35° 12′ and longitude west from ashington 1° 30′ and 6° 54′. Its total area is estimated at 30,570 square miles, embracing 30,170 of land and 0 of water surface, being about three-fifths the size of England and Wales. Of this area, some 7,500 square miles nsist of improved lands; the remaining 22,670 square miles are in forests, swamps, and marsh, almost all of ich may be easily reclaimed and improved, most of it being naturally by far the most fertile land in the state.

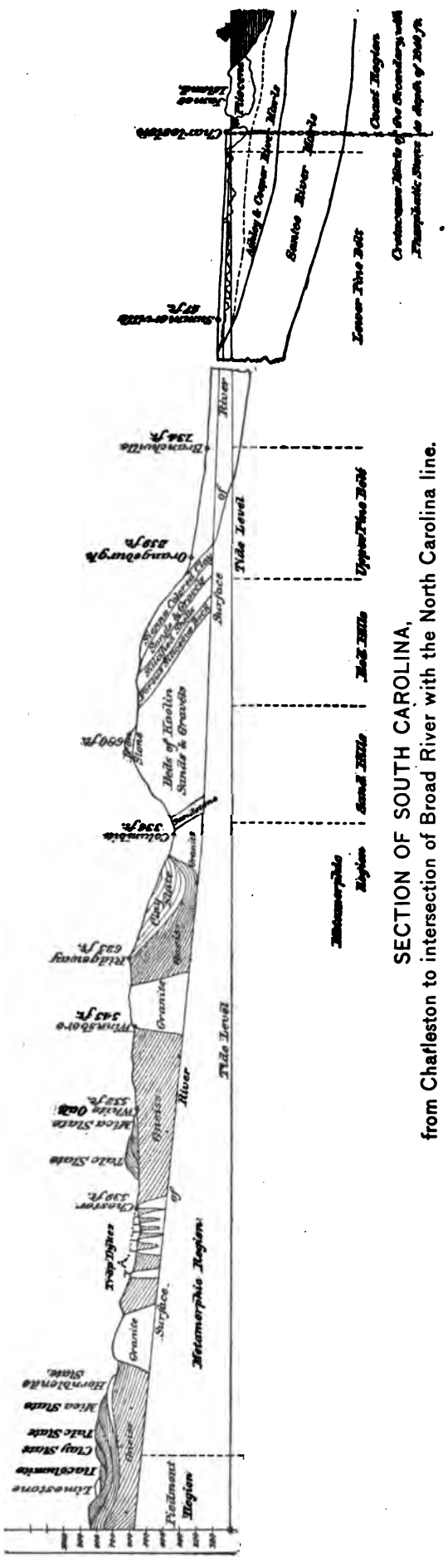
The state approaches in shape the form of an isosceles triangle, the equal sides being on the north, the undary line of North Carolina, and the Savannah river separating it on the south and west from Georgia. The ex of the triangle rests upon the summits of the Blue Ridge mountains. The base, sweeping with a gentle shaped curve from the southwest to the northeast, forms part of the great Atlantic shore line of North America. is line is parallel, or nearly so, with about one-half the coast lines of the continents of the earth.

Parallel with this coast line also trend the divisions between the various geological formations of the state. First, tending not more than ten miles inland, we have the strata of the post-Pliocene resting on the formations of the cene. These, with here and there a patch of the Miocene and of the Cretaceous, stretch back into the interior out one hundred miles, until they reach the crystalline rocks, whose well-marked line has, during the entire past story of the state, divided it socially, politically, and industrially, as well as physically, into what has always en known as the "up-country" and the "low country" of Carolina. This division of the state by the line unding the southern margin of the crystalline rocks trending northeast and southwest across its central portion strongly marked in everything—in the hills and highlands of the up-country with their heavy red-clay soils, and the gentle slopes or wide flats of lighter-colored sandy loam of the low country; in the rapid, turbid water- urses of the one, and in the slow, clear currents of the other; in the vegetable growth, the chestnut, the ciduous oaks, and the short-leaf pine occupying the up-country, and the long-leaf pine, the magnolia, and the ergreen oaks, with the long gray moss (*Tillandsia*), marking the low country; and lastly, in the manners, aracter, ancestry, and even in the very tones of voice of the inhabitants. Passing beyond the lower margin of e crystalline rocks and proceeding toward the mountains we find in all the various strata, in the order of their perposition—one above the other, the limestone, the itacolumite, the clay talc and mica slates, the gneiss, and e granite—that the same parallelism is maintained throughout, the prevailing strike in all being N. 20° to 30°

If we regard the movements of the atmosphere, we find here also that the predominating currents of the air ve in a northeast and southwest direction.

RIVERS.—Perpendicular to this direction—that is to say, in a southeasterly course—the four great rivers, with eir numerous tributaries that drain and irrigate South Carolina, make their way from the mountains to the sea. fore leaving the crystalline rocks—the point that marks their lower falls and the head of steam navigation—the ers have received the rapid currents of nearly all their affluents. Thereafter their stately flow proceeds more wly, passing the great inland swamps of the low country as if the waters still remembered when they found uance through these ancient deltas. As each river leaves the region of rocks to enter the borders of the low untry, it makes a sudden and well-marked detour eastward, except the Savannah, which seems to have had its d shifted westward at this line of demarkation.

Again, on the near approach of the rivers to the sea, some of them show a deflection westward. But the rallelism previously noticed does not obtain in this case. In some, as in the Pedee, the westward bend is ll marked. In others, as in the Edisto, the river is merely turned from an eastward to a north and south course;



SECTION OF SOUTH CAROLINA, from Charleston to intersection of Broad River with the North Carolina line.

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while the Santee seems scarcely at all diverted from its eastward course. It would not seem, therefore, as if this change had resulted from the action of any single cause, but rather that it was the resultant of opposing forces operating with varying intensities. Such forces would be found in the southeasterly currents of the streams themselves opposed by that southwesterly ocean current, a recurrent of the Gulf Stream, that sweeps along the Carolina coast. Where a river current was strong, and loaded with a wealth of detritus from the drainage of an extensive back country, it would hold its own against the ocean current, dam it out, and establish for itself the direction of its outlet. Hence the Santee piles up its banks and carries the shore-line out beyond cape Saint Romain, and all the coast southwest of it, the site of ancient and of actual deltas, is lined with the islands. Short and sluggish streams, however, supported by the detritus of no great water-shed, as the Waccamaw and Pedee rivers, would yield readily to the action of the ocean currents, conform to their direction, establish no nests of islands at their delta, but leave the sea to make a smooth, bare sand beach; such as the curving shore from Georgetown entrance to the North Carolina line, where, for twenty miles on a stretch, a carriage may roll along the beach at low water, leaving in the hard sands not the slightest impress of its wheels. The westward shifting of the channels of these streams is still going on, and is clearly recognizable on the charts of the Coast Survey in the deposition of sediment taking place at the mouths of all the rivers on this coast. The ship channels all lie to the south of the entrance to the harbors.

Crossing the crystalline rocks nearly at right angles, the waters in their course through the up-country encounter a series of natural dams, which, while it renders them easily available as water-powers, seriously obstructs navigation. The passage of boats of, say, two hundred tons burden, as a rule, reaches inland but very little further than the remarkable belt of high and healthy sand hills which lie along the lower borders of these rocks. But through the virgin forests of pine that cover the slopes and summits of these hills a water-power, measurable only by hundreds of thousands of horse-power, wastes itself away, unsubjected to the uses of man.

The tortuous courses into which the streams have been forced by the causes already stated, after entering the low country, while it has increased the navigable waters of the state, (giving, "apart from creeks and inlets of the sea, an inland navigation of 2,400 miles,") has seriously impeded the drainage of the low country, creating there some 5,500 square miles of swamp lands, which, though naturally, when reclaimed, of almost inexhaustible fertility, remain to this day for the most part waste, the prolific source of the miasms so deleterious to the health of this region. Numerous suggestions to remedy this evil have been made; but as yet nothing has been attempted on a scale commensurate with the importance of the undertaking. The legislature even refused, in 1846, to grant a charter to a company proposing to prolong the channel of the Edisto in a direct line through Wassamassaw swamp to the Ashley river; and a suggestion of a similar character made by Governor Seabrook, in 1848, for straightening the Santee through to the Cooper river and draining thereby Biggin, Fair Forest, Walleye, and the numerous adjacent swamps, met with no response. Such works would have reclaimed for the plow large bodies of soil, consisting of fine mud and decomposing vegetable matter resting at a depth of 5 to 10 feet on marl or gravel, and would have restored the adjoining uplands to remunerative culture, and established on a secure foundation the healthfulness of the entire region.

The Savannah river is now navigable for pole-boats carrying 50 bales of cotton for 154 miles above Augusta. The report of the Chief Engineer states that for an outlay of $188,000 a permanent channel 3 feet deep and 60 feet wide, of safe and easy navigation for such boats, could be made. For $97,000 in addition to the above 114 miles could be made into a steamboat channel 90 feet wide and 3 feet deep.

The Saluda river is navigable for the same class of boats for 84 miles above Columbia where it unites with the Broad to form the Congaree river.

The Broad river is navigable for this class of boats for 113 miles in South Carolina, and 28 miles in North Carolina above Columbia. It has a total length of 175 miles.

The Catawba river has a fall of 325 feet in the 55 miles of its course in South Carolina. Its banks are from 300 to 3,000 feet apart, and from 10 to 100 feet high. Above Rocky mount, in Chester, there is a fall at one point of 50 feet in 400 yards. The river has a total length of 272 miles, and its source is 2,500 feet above the level of the sea.

The data above given were obtained by surveys made in the driest season of a very dry year, and therefore represent these streams at extreme low water. This low stage of the water prevails during October and November. At other seasons the volume of water would be on the average two or three times as great. The rivers are subject to freshets rising from 20 to 30 feet above low-water mark, this rise being greatest where they issue from the metamorphic region. Together, these streams furnish a navigable highway of 405 miles which might be greatly and permanently improved and much increased for a moiety of what the same length of railroad would cost.

GEOLOGICAL FEATURES.—The rocks of the upper country of South Carolina are a continuation of and similar to those of middle North Carolina, identified by the geologist of that state, Professor W. C. Kerr, as belonging to the Laurentian and Huronian formations, disclosing in themselves no evidence, free from question, that any living things existed at the period when they were formed. It is upon their flanks, and largely from material furnished by their disintegration, that the whole series of formations composing the surface of the earth and marking the different geological eras of its history has been built up. In South Carolina these oldest rocks appear among the sands of the Tertiary, one of the most recent geological ages. The records of the intervening ages have disappeared.

The *granites* are among the oldest of these rocks, and have their outcrop in Carolina along three nearly parallel lines, as follows:

1. On the most southern of these lines the granite shows itself among the sand hills at Graniteville, on Horse creek, Aiken county, and thence at various points in a northeasterly direction to Columbia. Notable quarries for building materials are worked at Graniteville and at Granby, below Columbia.

2. The second line of outcrop extends from the neighborhood of Huns creek, Edgefield county, across Newberry, Fairfield, and Kershaw counties, to the northwestern corner of Chesterfield. In Edgefield, Newberry, and Fairfield the granite is associated with beds of hornblendic rock, and forms the substratum of a heavy dark-red clay loam, which is one of the best and strongest soils in the state. Here also quarries of excellent granite, fine grained and splitting easily, have been opened, especially in Newberry and Fairfield counties, where inexhaustible quantities of the best building granite are found. There is a beautiful flesh-colored porphyritic granite in Kershaw. In Chesterfield and Lancaster it becomes coarser and syenitic in character.

3. The third line of outcrop stretches through Laurens, Union, and York counties. In the vicinity of Union Court-House the granite is exceedingly fine grained and well adapted for architectural purposes; but the most of it on this line is characterized by a coarse porphyried structure, and is mostly decomposed.

Gneiss, or laminated granite, forms by far the larger portion of the rock underlying this region. No strict line of demarcation between it and the granite has been established. In mineral constituents, color, and grain they are alike, and seem to shale off insensibly into each other. This explains why, in nearly every township, the occurrence of rock, well adapted for building and called granite, is reported in greater or less quantities. The most marked difference is that, where the stratiform character of the gneiss is most marked, the hornblendic beds, which are associated with the granite and of such high value as a soil-maker, disappear. Although traversed by numerous veins, this rock has so far furnished nothing of importance to the miner in this state. Its general dip is slight and to the southeast. On its southern border, however, the gneiss rock is found with a vertical dip, as at Edgefield Court-House. South of the Saluda river, in Lexington, it is found between the granite and the clay slates, dipping northeast 80°. In Newberry, a coarse feldspathic gneiss, alternating with hornblende slate, forms an anticlinal ridge, dipping southeast on its southern and northwest on its northern slope.

Immediately overlying the gneiss are exposed belts of hornblende slate of no great breadth, and having nowhere an ascertained thickness exceeding 25 feet. These belts of hornblende generally surround isolated areas of mica-schists which overlie them. They are found chiefly toward the north along the base of the triangle formed by the affluents of the Santee, or to the west of this river system in Abbeville, Anderson, Greenville, and Pickens counties. They occupy the summit of ridges, as King's mountain, in York. On the water-courses they give place first to the hornblende slate and then to the gneiss, which forms almost everywhere the beds of the streams. They have an ascertained thickness exceeding in no single locality 100 feet. Shafts sunk in them have in several instances penetrated to the underlying gneiss. Mica thus occurs as large islands, the remnants perhaps of what may once have been a succession of wave-like parallel folds, dipping gently with the Atlantic slope to the southeast, and once

covering the entire surface, but worn away long ago under the erosive action of the present river system of the state. Numerous gold mines, and veins bearing copper, lead, and silver, have been found in these rocks and, to a limited extent, worked. The iron furnaces of Cowpens and Hurricane Shoals are also located in this formation. Mica of excellent quality has been mined in Dark Corner township, Anderson county, and in Abbeville. In the former locality beryl and copper are also found. Corundum and zircons are found in Hall township, Abbeville county, and in other localities. Asbestus occurs near Glenn Springs, Spartanburgh county, a noted health resort, the curative virtues of whose waters, with those of many other similar springs in this region, are due to the minerals dissolved from these mica-schists.

Next in the order of superposition above the mica slates occur extensive areas of talc slate. These rocks seem to have yielded even more completely to the erosive action of the rivers. They scarcely appear at all in the angle inclosed between the Catawba and the Saluda. Their largest outcrops are east of the Catawba, in Lancaster and Chesterfield counties, and separated from these by the whole width of the river system of the state, 80 miles to the southwest, across the Saluda, in Edgefield and Abbeville counties. These two localities are the great gold-bearing regions of the state.

On Broad river, near the northern boundary, where the counties of Union, York, and Spartanburgh corner, an interesting series of rocks occur, the most peculiar of which is a flexible sandstone, the itacolumite or diamond-bearing rock that gives its name to the group under the designation of the itacolumitic series. Thus far only one diamond has been found in South Carolina, though several have been obtained from the continuation of these rocks both in Georgia and in North Carolina.

South of the rocks above mentioned, and extending along the edge of the Tertiary from Edgefield to Chesterfield, a broad belt of clay slates occur. On their southern border among the sands of Lexington and Chesterfield counties, or just north of the granite in Kershaw, Richland, and Edgefield, these clay slates dip from 14° to 18° northwest. This angle increases further north until the slates stand vertically; still further on the dip changes to the southeast.

The trappean rocks are found chiefly on two lines. The principal one is the most southerly, and extends from Edgefield across to where the Catawba river enters the state. Their trend is a little more to the north of east than that of the other strata, which they therefore cross at an angle. Their greatest development is in Chester and York, where they form the substratum of a large body of very peculiar lands known as the "black-jack" lands. These trappean rocks show themselves along another line parallel with this one and to the north of it, stretching from Calhoun's Mills, in Abbeville, to the Lockhart shoals on Broad river, in Union. Here they also give rise to a peculiar body of lands known as the "flatwoods" of Abbeville and the "meadow lands" of Union.

Cretaceous.—Outcrops of the rocks of the Cretaceous formation occur east of the Santee river in numerous localities in the lower pine belt of South Carolina. Commencing at Little river, in the southeastern corner of Horry county, Professor Tuomey followed these rocks to Mars bluff, on the Great Pedee, and to points as far north as Darlington Court-House. They make their appearance on Lynch's river in about the same latitude, and were traced by Mr. Ruffin as far west as Kingstree, the county-seat of Williamsburgh. They consist of a soft marl, of a dark-gray color, containing, as at Mars bluff, the remains of *Belemnites* in great number. This marl averages about 34 per cent. of carbonate of lime, and rests on a stratum of hard lime or marl-stone, which yields 75 per cent. of carbonate of lime. This marl-stone rests on a black shale of laminated clay, which overlies beds of sand.

Tertiary.—The several divisions of this formation are represented in the state, the lowest—Eocene—being the most extensive, and may also be subdivided into several groups, viz, *sand hills*, with clays and recomposed granites, *buhr-stone*, *Santee marls*, and *Ashley* and *Cooper marls*.

Sand hills.—On the south of the metamorphic there is a belt of sand hills that form a dividing ridge between the more recent formations of the *low country* and the very ancient formations of the *upper country*. Their southern aspect overlooks the Tertiary plain descending to the sea-shore of the Atlantic. On the north they reach the clay slates (themselves dipping north of Edgefield, Lexington, Richland, and Chesterfield counties) and the granite and gneiss rocks of Kershaw county. Outcrops of these most ancient rocks also occur among the sand hills themselves.

Above the granite on Horse creek, in Aiken county, is found a sandstone composed of the ruins of granite consolidated into a pretty hard rock, thick ledges of which occur on the tops of the ridges in a number of localities. On Second creek, in Lexington county, Professor Tuomey found fragments of bones embedded in this sandstone, and recognized fossil shells belonging to the Eocene formation.

Interstratified with this sandstone are beds of loose sand, kaolin clay, and other variously colored clays having a vertical thickness estimated by Tuomey at 150 to 200 feet. Beds of pure white quartzose sand, well adapted for the manufacture of glass, occur. Quarries in the beds of kaolin have been opened in Aiken county and worked with much profit, both for the manufacture of porcelain and as an article shipped in quantities to northern markets.

Superimposed on the beds of loose sand and clay, in which no fossils are reported, is a siliceous rock, varying from a laminated siliceous clay to a hard rock having a jointed structure, breaking with a conchoidal fracture and resembling *menilite*. This curious rock has been traced from Aiken Court-House to the northern part of Clarendon county—where it is known as fuller's earth—nearly encircling the Charleston basin. On Congaree creek it is sawed into blocks, fashioned with an ax, and used in building chimneys. It hardens on exposure, resists disintegration

well, and its extreme lightness facilitates its carriage and handling. On this rock rest beds of silicified shells and masses of buhr-stone rock belonging to the earlier Eocene. Over all are spread beds of fine sand, covered here and there by beds of iron ore or ferruginous sandstone sometimes from 3 to 6 feet in thickness.

The region of red hills, which lies south of the sand hills, belongs to the buhr-stone formation of the Eocene. A sienna-colored clay loam forms the subsoil of this region. It rests on strata of siliceous clay and silicified shells. The clay rarely exceeds 20 feet in thickness and is underlaid by beds of coarse sand, gravel, buhr-stone, and kaolin clays. These kaolin clays appear at the surface in the sand-hill region, resting on beds of sandstone and grit, that cover the Horse creek granites, which extend, with the sand hills north of the region under consideration, from Graniteville to Columbia.

The *buhr-stone* is the lower and underlying member of the series of calcareous rocks forming the Charleston basin. It has been altered where it stands by the removal of the lime from the shells of which it is composed, and by the substitution of silica in its stead. Not only has the buhr-stone been traced by Professor Tuomey under the Santee marls, but the shells characteristic of these marls have been found in numerous localities in process of petrifaction.

No Eocene marl is found north of this ancient sea beach represented by the lower line of the buhr-stone formation. Masses of buhr-stone occur in numerous localities, sometimes showing a thickness of 30 feet. Quarries for millstones (said to equal the best French buhr-stone) have been opened and worked in these rocks. In Orangeburgh county, between the laminæ of clay, very distinct impressions of the leaves of the oak, beech, and willow are found. Petrified wood, frequently, as the trunks of large trees in considerable numbers, is found imbedded in the branches of this region. In Aiken and Chesterfield counties beds of lignite are known. They are underlaid by a clay shale, pronounced by Lieber equal to the best Stunbridge clay for fire-proof crucibles.

The body of the lower pine belt is underlaid by marl belonging to that portion of the Eocene formation of the Tertiary designated by Mr. Ruffin the Great Carolinian Belt. These marl-beds are divided into two well-marked groups, known as the Santee marls and as the Ashley and Cooper river marls. The Santee marls are the older, lower, and more extensive formation. Reaching from Mazyck's ferry, on the Santee river, in Charleston county, to Vance's ferry, on that river, in Orangeburgh county, and underlying nearly the whole of Clarendon county, they have been traced along Potato creek as far north as Sumter county. Westward they extend through Colleton Orangeburgh, Hampton, and Barnwell counties to the Savannah river, reaching as high up on that stream as Shell Bluff, a noted locality in Burke county, Georgia.

West of the Black river, in Sumter county, the line where the buhr-stone formation passes under the Santee marls traverses the center of the upper pine belt. North of it occur the silicified shells of the buhr-stone, south of it the coralline marls, both belonging to the Eocene Tertiary. West of the stream named, and in the direction of Darlington Court-House, occur numerous outcroppings of the Miocene marls, in Sumter and Darlington counties.

The Santee marl-bed forms the lowest member of the calcareous strata of the Charleston basin, and was designated by Professor Tuomey "the coralline bed of the Charleston basin", being composed of the remains of corals and gigantic oyster shells. It consists of strata of soft marl, marlstone, and greensand, and is very rich in carbonate of lime, averaging 90 per cent. of that valuable ingredient of the soil. The greensand marls, intercalated with them, contain 30 per cent. of carbonate of lime and 22 per cent. of greensand.

The marls of Sumter and Darlington examined by Professor Tuomey were found to contain from 60 to 70 per cent. of carbonate with traces of phosphate of lime.

Resting on the Santee marls, and passing out with them beneath the Pliocene and post-Pliocene of the coast under the sea to a great depth, are the Ashley and Cooper marls. Unlike the Santee marls, they contain neither corals nor oyster shells, but are composed of minute many-chambered shells (*Polythalamia* and *Foraminifera*). These marls are of a dark-gray color and granular texture, sometimes so compact as to render the material suitable for building purposes. They are not so rich as the Santee marls, and average only about 60 per cent. of carbonate of lime. They have long been known, however, to contain a notable quantity of phosphate of lime, and a great interest attaches to them, as they are the source of the nodules rich in phosphate of lime known as *phosphate rock*.

Phosphate rock.—The deposits of phosphate rock occur over a wide range of country, reaching from North Carolina to Florida, and extending in some instances as much as 60 miles inland. Vertically, so far as their occurrence in quantities of value economically is concerned, their distribution is confined within narrow limits. They are found at the bottom of rivers at a depth of from 20 to 30 feet, and on land they occur at an elevation but slightly above mean high tide, so that the tides of the existing sea, supplemented in a few instances perhaps by the action of storms, are sufficient to account for any movements that these water-worn nodules have undergone. The rock of commerce occurs always above the marl, and is known as the land or water rock, according as it is found in the one element or the other. The water rock is darker in color and harder than the land rock, and is frequently found in a layer or sheet of cemented or tightly-compacted nodules overlying the marl at the bottom of the rivers and creeks, where it either forms the bottom itself or is overlaid by a deposit of mud of greater or less depth. It has been seldom dredged for at a depth exceeding 20 feet. The land rock is found at a depth of from 2 to 10 feet (and more under elevations) below the surface of the soil, but is not mined at a depth exceeding from

beast than that of any other cultivated crop. In 1778, Mr. Lucas established on the Santee river the first water-power mill ever adapted to cleaning and preparing rice for market—the model to which all subsequent improvements were due—greatly diminishing the cost of this work. In 1828, 175,019 tierces were exported, and the crop of 1850 exceeded 250,000 tierces. That of 1860 was something less; and in 1870 the product tumbled headlong to 54,000 tierces.

Indigo.—In 1742, George Lucas, governor of Antigua, sent the first seeds of the indigo plant to Carolina, to his daughter Miss Eliza Lucas (afterward the mother of Charles Cotesworth Pinckney). With much perseverance, after several disappointments, she succeeded in growing the plant and extracting the indigo from it. Parliament shortly after placed a bounty on the production of indigo in British possessions; and this crop attained a rapid development in Carolina. In 1754, 216,924 pounds, and in 1775 1,107,660 pounds were produced. But the war with the mother country, the competition of indigo culture in the East Indies, the unpleasant odor emitted, and the swarms of flies attracted by the fermentation of the weeds in the vats, but above all the absorbing interest in the cotton crop, caused its rapid decline; and in the early part of this century it had ceased to be a staple product, although it was cultivated in remote places as late as 1848.

Indian corn.—Indian corn, the grain which, "next to rice, supplies food to the largest number of the human race," "the most valuable gift of the new world to the old," but a plant unknown to European culture, and in ill-repute as the food of the ever hostile red man, received little attention from the early settlers. Nevertheless, with the steadiness that marks true merit, it worked its way to the front rank among the crops grown in the state. As early as 1739 it had become an important article of export, and continued such until after 1792, in which year 99,985 bushels were exported. About this time, in consequence of the absorption by cotton of all surplus energy, it fell from the list of exports and shortly after entered that of imports, among which to-day—taken in all its forms—it stands by far the largest. But its culture was by no means abandoned; on the contrary, the crop grew in size with the increase of the population. In 1850 more than 16,000,000 bushels were produced. In consequence of the higher prices of cotton, the crop was reduced in 1860 by 1,000,000 bushels; in 1870 it had gone down one-half, having fallen to a little over 7,500,000 bushels.

Cotton.—Cotton is mentioned in the records of the colony as early as 1664, and in 1747 seven bags appear on the list of exports from Charleston. In 1787, Samuel Maverick and one Jeffrey shipped three bags of 100 pounds each of seed-cotton from Charleston to England as an experiment, and were informed for their pains by the consignees that it was not worth producing, as it could not be separated from the seed. In 1790, a manufactory of cotton homespuns was established by some Irish in Williamsburgh county, the lint used being picked from the seed by hand, a task of 4 pounds of lint per week being required of the field laborers in addition to their ordinary work. All this speedily changed with the invention of the saw gin by Eli Whitney, in 1794. The first gin moved by water-power was erected on Mill creek, near Monticello, in Fairfield, by Captain James Kincaid, in 1795. General Wade Hampton erected another near Columbia, in 1797, and the following year gathered from 600 acres 600 bales of cotton, and cotton planting became the leading industry in nearly every county in the state. The crop steadily increased in size until 1860, when the 350,000 bales produced in the state were worth something over $14,000,000. From this date to 1870 there was a great decline, the crop of that year being more than one-third less than the crop of ten years previous, and reaching only 224,500 bales. The course of this crop may be seen from the following table showing the crops of South Carolina:

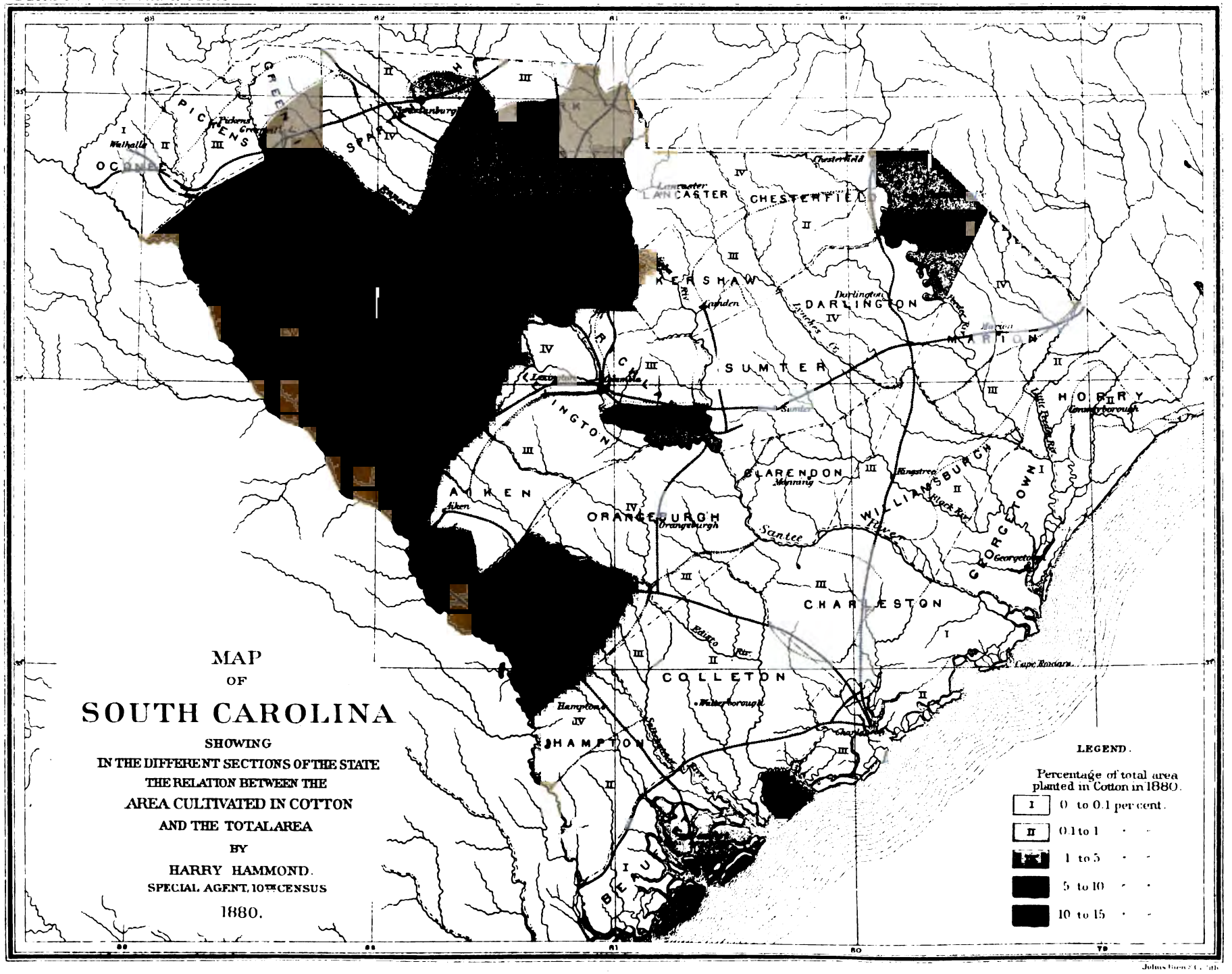
Year.	Bales.	Weight of bale.	Pounds of lint cotton.
1830	*185,166	341	63,446,606
1840	156,600	394	61,710,274
1850	300,301	429	128,829,129
1860	353,412	477	168,577,524
1870	224,500	442	90,229,000
1880	522,548	475	248,210,300

* Round bales.

Sea-Island cotton.—The first crop of sea-island cotton was raised on Hilton Head, in 1790, by William Elliott. This crop reached its year of maximum production in 1827, when 15,140,798 pounds of long-staple cotton were exported from the state; in 1841 it had fallen to 6,400,000 pounds. Since 1865–'66 this crop has fluctuated from a minimum, in 1867–'68, of 4,577 to a maximum, in 1872, of 13,186 bales. The crop, including the long-staple Mains and Santees, is set down at 9,966 bales, averaging 331 pounds, for the year 1880.

Even in so brief a summary as this, the attention of the reader must be called to the remarkable influence exerted on the three great crops, corn, cotton, and rice, by their culture on the South Carolina coast.

The finest, as food for man, of all the known varieties of corn is the white flint corn, a product peculiar to the sea islands.


PICKENS
OCONEE
GREENVILLE
SPARTANBURG
CHESTERFIELD
LANCASTER
KERSHAW
DARLINGTON
MARION
SUMTER
HORRY
RICHLAND
CLARENDON
WILLIAMSBURG
GEORGETOWN
AIKEN
ORANGEBURGH
CHARLESTON
COLLETON
HAMPTON
BEAUFORT
Walhalla
Pickens
Greenville
Spartanburg
Chesterfield
Lancaster
Camden
Darlington
Marion
Lynches Cr.
Sumter
Little Pedee Riv.
Conwayborough
Manning
Kingstree
Black Riv.
Santee
Georgetown
Aiken
Orangeburgh
Edisto Riv.
Cape Romain
Hamptonville
Walterborough
Charleston
Pocotaligo
Broad Riv.
Port Royal
MAP
OF
SOUTH CAROLINA
SHOWING
IN THE DIFFERENT SECTIONS OF THE STATE
THE RELATION BETWEEN THE
AREA CULTIVATED IN COTTON
AND THE TOTAL AREA
BY
HARRY HAMMOND.
SPECIAL AGENT, 10TH CENSUS
1880.
LEGEND.
Percentage of total area planted in Cotton in 1880.
I 0 to 0.1 per cent.
II 0.1 to 1 " "
1 to 5 " "
5 to 10 " "
10 to 15 " "

The finest cotton ever known to have been produced is the long-staple cotton of Edisto island, which has sold for $2 per pound when other cottons were bringing only 9 cents.

Carolina rice heads the list in the quotations of that article in all the markets of the world. Not only have its yield and culture been brought to the highest perfection here, but mankind are indebted to the planters of this coast for the mechanical inventions by which the preparation of this great food-stuff, instead of being the most costly and laborious, is made one of the easiest and cheapest.

THE COAST REGION.

The coast of Carolina, from the mouth of the Savannah river to that of Little river on the North Carolina line, is about 190 miles in length. East of the outlets of the rivers, that is, northeast of Winyaw bay, the coast-line curves inland, there are no islands, and the smooth hard beach that forms the continuous shore-line—noted for its delightful seaside residences during the summer months—is of little interest agriculturally. South of Winyaw bay, whence issue the waters of Black and Lynches river, and of the Great and Little Pedee with the Waccamaw, the Santee river, with its great water-shed in North and South Carolina, draining an extensive region stretching to the highest elevations of the Appalachian range, dikes out its delta into the waters of the ocean; the shore-line swells out toward the sea and becomes lined with numerous islands. From the point indicated to Charleston harbor, however, the islands, though numerous, are small and low; and in this distance of more than 50 miles, not more than 700 acres are planted in cotton, yielding about 275 bales of long staple. South of Charleston harbor the islands increase rapidly in size and number to the waters of Port Royal, where they line the shore in tiers three and four deep. They attain their maximum development around Broad river and diminish again in size and number, more rapidly even than they had increased, as they approach the Georgia line at the mouth of the Savannah river.

The coast region corresponds almost exactly with the area underlaid by post-Pliocene formation. It embraces nearly all of Beaufort county, comparatively small portions of Colleton and Charleston, and but very narrow strips of Georgetown and Horry counties. Its strata of sand, clay, and mud have an estimated thickness of about 60 feet, stretching inland some 10 miles, and thinning out at a slight elevation above tide-water. They rest in Horry and Georgetown on the Pliocene, and for the remainder of the coast on the Eocene, in which occur the phosphate deposits of the Ashley, the Cooper, and the Coosaw rivers.

The *origin and formation* of the sea islands may be accounted for by one of four possible suppositions:

1. By the subsidence of the coast, resulting in the submergence of the lower lands. This explanation was offered by Sir Charles Lyell.

2. By the erosive action of the tides and currents of the sea cutting into the shore and detaching portions of the mainland; a theory broached by Professor Shaler.

3. By an outgrowth of the land into the sea, resulting from the deposition at the mouths of the rivers of the detritus brought down by their currents from the interior.

Professor Tuomey shows in detail that the instances of the submergence of live-oak, pine, and cypress trees and of other landmarks occur in localities of restricted area; that encroachments of a purely local character by the sea after storms explains the phenomena; and that if it were admitted that the submerged live-oak and pine stumps near Little River, or the dead cedars and cypress of the "church flats" at Wadmalaw, was evidence of a settling down of the coast, the rate at which this is progressing according to these data is so rapid, that on this low-lying shore sea-water would long since have been admitted to the rice plantations, totally destroying them.

That the sea islands have not resulted from the erosive action of the sea is proved by the fact, however, that there is not a single island on the incurving line of eroded coast north of Winyaw bay. On the contrary, it is only where the land bellies out into the sea near where the large rivers deliver their detritus to its waves that the sea islands make their appearance. At this point—namely, at Georgetown entrance—we look in vain for evidences of erosion. The records all point the other way, that is, to a gradual encroachment of the land upon the sea. Thus, in the year 1700, the Rising Sun, a large vessel with 346 passengers, that could not cross the Charleston bar, made its way without a pilot to the present site of Georgetown, a thing utterly impossible during the last 100 years. Moreover, a comparison of the soundings on chart No. 428 of United States Coast Survey of 1877, with a chart of the same locality published in Drayton's *View of South Carolina* in 1802, shows that, instead of any scouring out or erosion, there has been a great filling up in the interval. Seaward from Georgetown light-house, Drayton gives depths of from 9 to 30 feet, where Captain Boutelle only found from 6½ to 19 feet of water. Inside the entrance, where the water once was from 30 to 36 feet, the mean level of low tide now only gives a depth of from 9 to 31 feet. Ten soundings taken off South island average now 7½ feet, while ten soundings in the same locality on Drayton's chart average 18 feet.

It would seem then that the sea islands were an outgrowth of the land into the sea, and that this is but a continuation of that long process by which the Tertiary plain itself, reaching inland to the chain of the Appalachians, was formed. The broadest portion of this plain lies under the vestiges of the loftiest of these mountains, whose

denudation has furnished the most abundant material for its formation. Northward, under lesser elevations that could only furnish less material, the plain wedges out and the sea approaches the rocks. The slow uniformity of this process of growth is shown by the gentle and uniform slope with which this plain approaches the sea. Nor does it end abruptly there. For 100 miles or more the sea scarcely exceeds in depth 100 fathoms, and then suddenly deepens to 2,000 fathoms under the Gulf stream. The sea islands are not isolated phenomena, but only the successors to that stage of growth which was in progress in the interior long ago. There an intricate network of swamps and bays corresponds with the present inlets, creeks, and rivers of the coast, representing the old channels and deltas of the rivers when the pine flats and ridges now resting in the meshes of this network were themselves veritable sea islands.

Professor Tuomey refers to Murphy's island, south of S. Santee inlet, as furnishing a typical illustration of the manner in which this occurs. He says:

> A bar is formed at the mouth of the river by the action of the ocean. Breakers make their appearance seaward, and gradually push forward the sand as they approach the shore. When the sand rises above the surface the water becomes too shallow to produce breakers; they disappear and commence again off the shore and further south. An eddy is formed between the sand-bar and the shore, in which the river deposits its sediment; from an eddy it is changed, first, into a lagoon, and then into a mud-flat, which increases until the level of high water is reached. It then becomes a marsh and is taken possession of by the marsh reed, to be succeeded when the *débris* collected by their growth has raised the locality above high water, by tufts of rushes. Meanwhile seaward, the sands, first pushed up against the outflowing current of the river by the ocean, are dried by the sun and then blown forward and heaped into hills and ridges, forming a protection against the encroachments of the waters whence they came. Every breeze blowing landward carries along with it particles of fine sand, till they meet with a log or bush or other obstacles, when they begin to accumulate in proportion to the velocity of the wind, sometimes with extraordinary rapidity—piling up and running over the top, rising in ridges and hills to the height of 30 or even of 40 feet. The prevailing winds of this region, the southwest and northeast, are indicated by valleys running in this direction through these hills.

In the manner thus described, the salt water of the ocean being excluded, the surgent island is prepared for the growth of fresh-water plants, such as the cypress and other swamp trees, while pines and palmettos—the advanced guard, as it were, of the vegetable kingdom—establish outposts wherever a few inches of intervening sand renders them safe from immediate contact with sea-water. This theory of the origin and formation of the sea island furnishes explanations of some facts pretty generally observed, as the following: The borders of these islands are usually the highest lands on them, showing their fluviatile origin; the prevailing shape of the islands is triangular, the apex always directed to the southwest; the marshes are principally found at the southwest extremities of these triangles; the long slopes are west and south, the short slopes are east and north. This last peculiarity prevails far back into the interior of the country, the bluffs being on the west and south of the streams and the swamps on the north and east.

SURFACE FEATURES.—In approaching the coast from the sea, about the time the white caps of the first breakers are seen, a long low line of smooth, hard, sandy beach, for the most part of a snowy whiteness, makes its appearance. Immediately inland from the beach swell the undulating ridges of drifting sand, ripple-marked by the action of the wind in striking similarity to the wave-marks of water.

Here the palmetto meets you, standing often solitary and alone, a conspicuous landmark in the picture. Beyond rise the dark-green turrets of the pine, beneath which a tangled growth of myrtles and vines is found. Sometimes more than one ridge of sand hills, with an average elevation of 10 or 15 feet, must be traversed before the border of the salt marsh is reached. The salt marshes, their stiff green reeds rising out of the black ooze visible at low tide, and at the flood apparently floating on the water, with here and there a stray palmetto or a group of undersized live-oaks, their limbs covered with the long gray moss, form the scarcely varying frame-work of all landscapes among the sea islands. Everywhere these marshes are penetrated by salt rivers and creeks of greater or less width and depth, and surround islands which vary from a few acres to many square miles in area. These islands attain a height of from 10 to 15 feet—rarely of 25 or 30—above high tide. The mean rise and fall of the tides is 6.9 feet at the mouth of the Savannah river, 6.7 feet at Port Royal, 5.1 feet at Charleston harbor, and 3.5 feet at Georgetown entrance, showing a marked diminution as you advance northeast along the coast. The influence of the tide extends to a distance of 30 miles in a direct line from the sea up the Savannah river and about 15 miles up the Santee. Salt water, however, usually ascends the Santee river only about 2 miles, and even when the current of the river is diminished in seasons of great drought, not more than 4 miles. Up Georgetown bay it reaches farther, and is sometimes injurious to the crops at a distance of 14 miles. What has been said of the Santee is true to nearly the same extent of the Savannah river.

CLIMATE.—Notwithstanding their proximity to the mainland, the sea islands enjoy in a high degree the equable climate peculiar to islands generally. The extremes of temperature are, as might be expected, greatest in the direction of low temperature, and the cold, which is sometimes injurious to the orange and the olive trees, destroys also the germs of many insects inimical to vegetation, as of the cotton caterpillar, and of more importance still, it destroys the germs of disease, as of the yellow fever and of numerous skin diseases that flourish in similar regions elsewhere, preventing them from becoming indigenous and keeping them exotics, forever requiring yearly renewal from without.

The following table presents the leading features of the coast climate, as preserved in the records of meteorological observations made at Charleston, South Carolina:

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Notwithstanding the amount of rainfall and proximity to the sea, the climate is not excessively moist. There is a large number of clear days, averaging about 235 during the year, against an average of 86 days in which rain falls, and 44 cloudy and rainless days. Fogs are of very infrequent occurrence. Vegetation is usually checked by cold for not more than six weeks in the year, from the middle of December to the first of February. Nature does not allow the inhabitants of higher latitudes to become purely agricultural in their pursuits, forcing them, during the snows and ice of winter, to seek occupation in other arts and industries. But here she bares her bosom the year round to furnish food and work for man, and seed-time and harvest occur in every month.

HEALTH.—Death and ill-health in South Carolina cannot be attributed to the preponderance of any climatic or local causes, but supervene from such causes as may and must exist everywhere. This negative conclusion may be safely accepted as descriptive of the sanitary condition of the state at large. There has been, however, and not without some foundation, an idea prevalent regarding the unhealthfulness of the coast region, arising from malarial causes, which requires mention, especially as occurrences of recent date have greatly modified it. The sand ridges between the rivers have always been esteemed healthy; the well-kept vital statistics of the city (*a*) of Charleston show that its health record will compare favorably with that of other cities; and numerous localities along the coast, as Mount Pleasant, Sullivan's island, and Beaufort, and many other places, have been much frequented as health resorts during the summer months, even by people from the up-country. It was confidently predicted at the commencement of the late war that no picket line along the coast between the armies could be maintained during the summer and autumn months. To the surprise of nearly every one, however, such did not prove to be the case. Climatic influences interfered in no way with the vigorous prosecution of hostilities, and it was demonstrated that large bodies of white men, under proper hygienic regulations, with the use of quinine as a preventive, might be safely counted on to endure unusual exposure and toil on these shores during the heat of summer. Since the war numerous white families, who formerly removed to the north or to the up-country during summer, have remained upon their farms the year round in the enjoyment of their usual health. By the census enumeration of June, 1880, the death rate among the rural population of the entire sea-island district was 14 per 1,000 for the preceding year. Of the 23 white men who were enumerators of the Tenth Census on the sea islands during the months of June and July, 1880, there was no day lost from work on account of sickness, though many of them were unaccustomed to the exposures which the work necessitated. Doubtless the prophylactic use of quinine has had something to do with the apparently increased healthfulness of this section, but it is also true that the danger to health was formerly greatly overestimated. With thorough drainage and careful attention to the rules of health, and especially to securing pure drinking water, there is no question that fevers might be expelled here as completely as they were from the fens of Cambridgeshire, in England, where they once prevailed but have since yielded to the above methods. During the excessively hot and dry summer of 1728, "yellow fever" made its first appearance in Charleston. At greater or less intervals of time it has since visited the city during the autumn months. After 1748 it did not make its appearance during a period of forty-four years. John Drayton writes in 1801 to the natives and old inhabitants of the city, "it has not yet been injurious." The germs of this disease have never been naturalized on this coast, and require a fresh importation every year. An epidemic occurring in Charleston during the war was clearly traced to a vessel from Havana that had run the blockade, and, as Mr. Drayton describes it, it still remains restricted to certain localities, within a few miles of which perfect immunity from it may be enjoyed. This was clearly shown in the very fatal epidemic imported into Port Royal in 1876, causing a number of deaths there, while no case originated in the town of Beaufort, 4 miles distant, to which place, however, patients suffering from the disease in Port Royal were carried for treatment.

SOILS OF THE COAST REGION.—The soil of the sea island consists, for the greater part, of a fine, sandy loam. This soil rests on a subsoil of yellow sand or yellow clay of fine texture, and deepening in color sometimes to red. These clays give a yellow hue to the otherwise gray surface, which is noticed by Mr. Seabrook as indicating lands peculiarly adapted for the production of the silky fiber of long-staple cotton. Beside these lands there are numerous flats or fresh-water swamps, known as bays. Here and there a few of these have been reclaimed by drainage. The soil is a black vegetable mould of great fertility, resting on fine blue mud and marl. To a very limited extent the salt marsh has also been reclaimed, but as yet agriculture has availed itself so little of the vast possibilities in this line, that the chief value of the salt marsh attaches to its use in furnishing forage and litter for stock, and inexhaustible material for the compost heap. Low as these lands lie they are susceptible of easy drainage. The following analyses will indicate more in detail the character of these soils.

No. 6. *Sandy soil* from the northeast end of James island, taken 12 inches deep, and analyzed for the Census Office. This soil may be considered a specimen of the less sandy soils of the sea islands. Such lands will yield about 300 pounds of long-staple lint one year with another.

No. 12. *Soil* from J. J. Mikell's place on Edisto island, famous for having long and profitably produced the finest grade of sea-island cotton. It may be considered a representative soil, and was analyzed by Professor C. U. Shepard.

No. 13. *Soil of the salt marsh*, air-dried; analyzed by Professor Shepard.

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a The official report of the board of health of the city of Charleston for the year 1880 shows 500 deaths for 22,712 of white population, or 22 deaths per 1,000, and 1,121 deaths for 27,287 of colored population, or 41 deaths per 1,000.

THE LOWER PINE BELT, OR SAVANNA REGION.

Contiguous to and immediately inland from the coast region lies the lower pine belt or savanna region of South Carolina. This section includes the southern and eastern part of Hampton county, nearly all of Colleton, two townships in Orangeburgh, all but the northwest corner of Clarendon, the southwest portion of Marion, the whole of Williamsburgh, and all Charleston, Georgetown, and Horry counties not lying on the coast, and comprises nearly one-fourth of the entire state.

SURFACE FEATURES.—The surface features of the lower pine belt bear a striking analogy to those of the coast region. The uplands, the so-called "pine barrens", represent the sea islands. Numerous large fresh-water rivers replace the great salt-water inlets and arms of the sea along the coast, and the interminable network of extensive swamps and bays recall the salt marshes of the coast. Eight large rivers, receiving all the water that falls in South Carolina and a large proportion from the water-shed of North Carolina, besides several smaller rivers and innumerable lesser streams, traverse this region, and furnish more than 1,000 miles of navigable waters. The general appearance of the country is low and flat. The uniform level of the surface is scarcely broken anywhere, except here and there on the banks of the streams by the occurrence of slightly rolling lands. Its maximum elevation above tide-water, 134 feet, is reached at the village of Branchville, on the South Carolina railroad. From the data furnished by the surveys of the railroads traversing this region,(*a*) the Port Royal, South Carolina, and Wilmington roads, it appears that the average slope is about 3½ feet per mile. This slope, however, seems to be much more rapid in the western and narrower part than it is in the eastern and broader portion of the belt. Altmans, on the Port Royal railroad, is 105 feet above mean high tide at the head of Broad river, 18 miles distant in a direct line, giving a fall of 5.8 feet per mile. Branchville is 134 feet above the sea, which, at North Edisto inlet near Jehossee island, is 48 miles distant, making the fall 2.8 feet per mile. In the east the railroad bridge of the Great Pedee is 52 miles from the sea, and has an elevation above it of only about 59 feet, or but little more than one foot to the mile. This fall would, with skillful engineering, be sufficient for thorough drainage as well as for irrigation. Left as it is, however, wholly to the operations of nature, this desirable object is far from being accomplished, and the broad but slow currents of the tortuous streams never free the swamps and lowlands of their superfluous water. In connection with drainage and the embankment of the rivers, the assertion is frequently made, that such works are less practicable now than formerly, in consequence of the increased size and frequency of freshets, resulting from clearing the forests, the chief obstructions to the rapid passage of rainwater into the streams. In the absence of records giving exact data on this point, this assertion rests on the apparent nature of the case rather than on ascertained facts. On the contrary, nothing can be more certain than that no subsequent freshet has attained the height and extent of the great flood of 1796, known as the Yazoo freshet.

TIMBER GROWTH.—The characteristic timber growth of the uplands is the long-leaf pine, extending in open pine woods over the wide plain, with scarcely any undergrowth except here and there the scrub oak and grasses of the genus *Aristida* and *Sporobolus*, the wire and drop-seed grass. The palmetto reaches only a few miles inland from salt water, but the live-oak is found as much as 60 miles from the shore-line. The magnolia, tulip tree, sweet and black gum, white and red bays, white oak, black walnut, elm, hickory, and cypress are among the largest and most conspicuous trees of the swamps, the dense undergrowth commencing with a fringe of gall-berry (*Prinos glaber*) on the margin of the swamps, and consisting of a great variety of grape, brier, and other vines, myrtles, etc.

CLIMATE.—In the absence of weather records, it is difficult to express the difference between the climate of the lower pine belt and that of the sea-coast, already described, more definitely than to say that it is such difference as is to be found between the conditions favorable for the growth of the cabbage palmetto which barely touches the southern border of the belt, and of the live-oak that just extends to its northern or inland margin. A low, flat country intersected by numerous swamps might naturally be thought very sickly. This region, however, has one advantage: almost everywhere there are found small tracts, islands as it were, of dry, sandy soil, heavily timbered with the long-leaf pine, which is a barrier to the invasion of malaria. These retreats furnish places of residence as healthy as are to be found anywhere; such a place is the village of Summerville, on the South Carolina railroad, a health resort that divides with Sullivan's island the patronage of the citizens of Charleston during the warm weather. McPhersonville, in Hampton, and Pineville, in Georgetown county, are villages of the same character, and there is scarcely a neighborhood that has not some such healthy spot as a place of residence during summer. The dread of malaria is much less than it was, when the opinion that the colored race was exempt from such influences was adduced as an argument to show the providential nature of their location here, to develop these fertile lands. The reverses of fortune, sustained as a result of the war, have forced many white families to reside the summer long where it was once thought fatal to do so, and the experiment has been successful, thus exploding the extravagant idea that white people could not enjoy health here during the summer months. Replies from twenty-three townships state, without exception, that the inhabitants enjoy good health, and that a considerable proportion of the field work is performed by whites, a great change since the war. The census returns give 15 deaths per 1,000 population in the portions of Charleston and Colleton counties lying in this region, for the year 1880.

a The Charleston and Savannah road runs near to and parallel with the coast, and the surveys of the Northeastern road have been destroyed.

The water culture of rice is conducted on three sorts of low grounds: 1st. Flats which may be irrigated from ponds or water "reserves" lying at high level. 2d. River swamps into which water may be conducted by canals running from the river above, and returned to it again at a lower level; such lands may be found anywhere in the state. 3d. The tide-water lands, which are only found near the coast. These lands lie in such a position on the lower course of the rivers, that while they are subject to a sufficient "pitch of the tide" to irrigate them on the flood and to drain them on the ebb, they are free from the invasion of salt-water below and from the freshets that occur higher up on the streams. By taking in the fresh water from the rivers above and letting it out below at low tide, these lands have been reclaimed as low down as the salt marshes. They are of limited area and of inexhaustible fertility, the waste of cultivation being constantly restored by the rich deposits from the turbid streams that irrigate them. Formerly their value was estimated in hundreds of dollars per acre. Since the war the difficulty of obtaining labor has changed this, many of the finest plantations remain uncultivated, or only partially cultivated, and lands once worth from $200 to $300 per acre may now be bought at from $20 to $30, or less. There are more than 2,000,000 of acres of land consisting of inland and river swamps and of fresh water and of salt marshes, admirably adapted to rice culture, now lying unused in this section of the state, most of it in its original wilderness.

There are numerous methods employed in the water culture of rice, from that known as dry culture, when water is sparingly used, to that known as the "all-water culture", where the crop is only dried once or twice during the season for the purpose of weeding it. Usually it is "flowed" four times, the floodings being severally known as the "sprout flow", to perfect the germination; the "point flow", to stretch up the young plant; the "long flow", when the plant is six to eight inches high, after the first and second hoeings; and the "lay-by flow", after the third hoeing and until harvest. The fine mud and decomposed vegetable matter composing these soils is so soft that a horse will readily bog in it, and therefore horse-power has been little used in their cultivation; an objection that, with the solid cross-dams at short distances, would not apply to the plow moved by steam-power. Horse-power has, however, been used so far as to show that seed-drills for planting and the mowing machine for harvesting may be successfully employed in rice culture. Under these circumstances, taking into consideration the amount and certainty of the yield (from 40 to 80 bushels per acre), and the improved machinery for thrashing and hulling, there is perhaps no food crop so entirely under the control of mechanical inventions, and so little subject either to the vicissitudes of season or the uncertainties of human labor as the rice crop. The stem is much superior as forage to that of any of the small grain, and, except the hulls of the grain, there is no waste in the crop; the very dust from the pounding, known as rice flour, being most nutritious food for stock.

Although 80 bushels per acre is generally given as a large field crop, the possibilities of the product are much greater. The rice crop for the whole state averages 20 bushels to the acre. This means 600 pounds of merchantable rice worth, say, $30; 400 pounds of straw, worth $2.80; and 100 pounds of flour, $1.50; in all, $35.30. Cotton gives an average of 181 pounds per acre, which, at 10 cents, would be only $18.10, or a little over half the gross yield of rice. Why is it, then, that rice culture is in so depressed a condition, and cotton culture so flourishing? In answer to this question, the reason may be briefly stated to be that condition of industry which favors small enterprises and discourages the cumulation of capital in large investments and the organization of labor into large masses, which the embankment, drainage, and irrigation of a rice-field requires.

The allurement of the ready money realized by collecting the products of the forest, and by rice and by cotton culture, has diverted attention from other crops in this section. The culture of corn as a market crop would be profitable; the red rust-proof oat is admirably adapted to this climate, and is one of the most certain crops, yielding readily from 30 to 50 bushels to the acre. Although New England and even European hay has for many years been purchased to subsist, in part, the work stock in this section, Mr. Ruffin, who came from the clover-fields of Virginia, says in his official report on the agriculture of the lower and middle parts of South Carolina: "Few countries possess greater natural facilities, or which are more improvable by industry, for producing in abundance grasses, hay, and live stock and their products of meat, butter, and milk, all of which are now so deplorably deficient."

STATISTICS.—The lower pine belt contains about 7,210 square miles, of which 4,500 are alluvial or swamp lands, either covered with water or subject to overflow. The tilled land is 358,533 acres, by the census returns of 1880, which is 30 per cent., or 171,306 acres less than the number given by the census of 1870. There are 1.6 farms and 49 acres of tilled land per square mile, or 20 acres of tilled and 400 acres of untilled land to the farm. Something less than 1 per cent. of the total area, or 6.4 acres per square mile, is planted in cotton; there is in grain of all kinds 15.8 acres, and in other crops and fallow 13 acres per square mile, with 1.8 head of work stock and 23 head of all live stock. These figures represent the minimum (the area in other crops and fallow alone excepted) to be found anywhere in the state. Notwithstanding the small proportion of stock to area, the people here are the staunchest adherents of the fence law, and claim entire freedom of range for their cattle. This, too, while the number of stock of all sorts is only 1.15 per capita, being less than in any part of the state, except upon the coast.

The population numbers 203,748 (including 49,999 in the city of Charleston), or 28 per square mile, which is less than in any part of the state, the sand hills excepted, where the number is 11.7. The ratio of colored to white is greater than elsewhere except upon the coast, and is 69 per cent., the same that it was given at in 1870.

The tilled land is 1.7 acres per capita; 0.2 acres more than on the coast. This is not quite one-half the average for the whole state, and is owing, 1st, to the large area of unreclaimed swamps; 2d, to the number of the population engaged in the turpentine and lumber business. The large bodies of land held solely for the forest products they yield, as turpentine, lumber, shingles, staves, etc., accounts for the fact that while the number of farms to the square mile is few, the number in proportion to the population is as great, even as among the small farms on the coast, being 1 to every 12½ of the population. Nevertheless the amount of land tilled per capita has decreased 38 per cent. since 1870, showing that the forest industries are gaining on agriculture.

Although the lower pine belt comprises nearly one-fourth of the state, it produces only a fraction over 5 per cent. of the cotton crop. The percentage of the total area planted in cotton is less than one-tenth of one per cent. in the southeastern third of Charleston, in the whole of Georgetown, and in the greater portion of Horry county. From one-tenth to one per cent. of the area is planted in cotton in the lower half of Hampton, in Colleton, in the northeastern portion of Charleston, in the southern third of Williamsburgh, and in portions of Horry county. From 1 to 5 per cent. of the area is planted in cotton in the northeastern corner of Colleton, in the northeastern part of Charleston, in the upper two-thirds of Williamsburgh, in the lower one-fourth of Marion, and in Clarendon county.

In point of production we have 2.7 bales of cotton per square mile against 1.9 in 1870, an increase of 42 per cent., but still less than half the minimum produced elsewhere except on the coast. Per capita the yield is only 68 pounds of lint, but per acre planted in cotton it is 171 pounds, showing that in this little cultivated region the yield of the land planted is but little below the average of the state. So, too, of the grain crop, while it was only 7 bushels in 1870, and in 1880 only 11 bushels per capita, and only 236 bushels to the square mile, it averages over 15 bushels to every acre planted, which is nearly 50 per cent. above the average of the state. The increase in the amount of grain produced has been 82 per cent. on the crop of 1870. The work stock during the same period has increased 50 per cent., and the live stock 76 per cent.

The explanation of these seemingly paradoxical facts is that this fertile but thinly-peopled region is scarcely reclaimed at all from the dominion of the waters for man's uses; there being neither capital nor organized labor commensurate with this undertaking, what of either of these forces is to be found employs itself in cultivating the poorer but more easily tilled land, or in the more tempting occupation still of gathering the products of the forest, which nature with lavish hand offers in abundance.

THE UPPER PINE BELT.

The upper pine belt of South Carolina is sometimes called the "middle country", as distinguished from the "upper country" and the "low country", between which it lies. It has also been known as the central cotton region of Carolina, having formerly led, as it still does in some respects, in the culture of that staple. It may be defined as that portion of the state lying at an elevation above the sea of between 130 and 250 feet. It crosses the state in a northeast direction, from the Savannah river to the North Carolina line. To the south it is bounded by the lower pine belt, where the flat open pine woods, with an undergrowth of coarse grasses, gradually give place to higher and more rolling pine lands, with an undergrowth of oak and hickory. To the north the upper pine belt sweeps round the base of the interrupted range of high red hills which traverse the state, or rises, in the intervals of this range, into the still more elevated sand hills. It comprises generally the counties of Barnwell, Orangeburgh, Sumter, Darlington, Marlborough, and Marion, the northern half of Hampton, and the northwest corner of Colleton. Along the rivers it penetrates northward beyond the limits of the counties named. As uplands on the first level above the swamps it extends, in Aiken county, as high up the Savannah as Old Fort Moore, at Sand Bar ferry; in Richland it reaches along the Congaree nearly to Columbia, embracing the wide level area of Lower township, lying between that river and the sand hills; along the Wateree, between the swamps and the high hills of Santee, it passes into Kershaw county, and along the Great Pedee it passes up among the sand hills of Chesterfield.

SURFACE FEATURES.—The land is level without being flat, and is sufficiently rolling to insure good drainage for the most part. While the general slope follows the southeasterly course of the rivers, the land rises more rapidly in the west, which gives the region a marked easterly slope in addition to its southeastern inclination. Thus, in the west, Appleton, on the Port Royal railroad, 46 miles distant from tide-water, has an elevation of 259 feet, while Orangeburgh, on the South Carolina railroad, 65 miles from tide-water, has only the same elevation, and Wedgefield, on the Manchester and Wilmington road, 75 miles from tide-water, has an elevation of only 236 feet, these being the highest points on the respective roads.

The water courses rising in this region, or in the sand hill region above, are clear and rapid, while the larger rivers passing through it, that come from the mountains, are turbid. The latter furnish this region with valuable facilities for the transportation of produce. On the western side, the Savannah is navigable to Augusta for steamboats of from 200 to 300 tons burden. The Salkehatchie river, rising in Barnwell county, might be rendered navigable to the county-seat by removing logs. The two Edistos might be rendered navigable for small steamboats, and if the contemplated canal connecting those streams with Ashley river were opened it would become an

important avenue for the cheap transportation of produce. Steamboats carrying from 800 to 1,000 bales of cotton have passed up the Santee and its confluents, the Congaree and Wateree, as far as Granby (2 miles below Columbia), and to Camden. In the east the Great Pedee is navigated by steamers to Cheraw, 120 miles in an air line from the sea; for smaller craft Lynches river (the Kaddipah) and Black creek were navigable, the one 80 and the other 30 miles from where they join the Great Pedee. The Little Pedee is also navigable for vessels of considerable burden. Beside the large streams mentioned there are numerous smaller ones in this region, flowing with a rapid current through healthy localities heavily timbered with pine, and capable of furnishing water-powers sufficient for the largest factories. On the ridge between the North and South Edisto, in Orangeburgh county, springs of fine drinking water furnish a water-power, sufficient for grinding and ginning, a few hundred feet from the spot whence they issue from the earth. There are numerous small lakes, chiefly in the swamps, but sometimes on the uplands; in Barnwell there is one, a beautiful sheet of clear water, 2 miles in circumference, with a beach-like shore affording a fine drive, and surrounded on all sides by high and healthy pine uplands.

Wells.—Shallow "sweep" wells (the bucket being attached to a pole fastened to a long lever balanced near its middle) are characteristic of this region; generally they are from 10 to 20 feet in depth, with only a short wooden curb on top, for the rest uncurbed, being dug through a fine compact yellow or red clay to a stratum of quicksand, in which an abundant supply of pure and cool water is found.

TIMBER GROWTH.—The region is covered with a rather sparse growth of large long-leaf or yellow pine, with an undergrowth of oaks and hickories. Among the eight or ten species of oaks, the live oak does not appear, except as a planted tree; the water oak, however, attains perfection, covering with its evergreen foliage, not unfrequently, an area of half an acre, and measuring from 8 to 10 feet through at the root. Of the upland oaks, I mention the forked-leaf black-jack, indicative here of a dry and thirsty soil; and the round-leaf black-jack, showing a moister and more fruitful soil. Dogwood is also common. Here is the northern limit of the magnolia in its wild state, and of the gray moss (*Tillandsia*). The swamp woods are cypress, white oak, gum, ash, hickory, beach, elm, and black walnut.

The early settlers in this region were stock raisers, and kept up the Indian practice of burning off the woods during the winter. The destruction of the undergrowth by this means favored the growth of grasses, and numerous herds of almost wild cattle and horses found abundant pasturage chiefly upon what was known as the wild oat, and the wild pea-vine. The cattle were sometimes slaughtered for their hide and tallow. The names of many townships and neighborhoods still testify to this primitive industry, as Steer Pen, Steerpoint, Horse Pen, and Pen Corner. The uplands were covered, as they still are, with a large growth of yellow pine, and a deer might have been seen in the vistas, made by their smooth stems, a distance of half a mile; where now, since the discontinuance of the spring and autumn fires, it could not be seen 15 paces, because of the thick growth of oak and hickory that has taken the land.

CLIMATE.—The upper pine belt is a peculiarly healthy region, and throughout its extent a remarkable number of instances of unusual longevity are reported. There are no prevailing diseases, unless it be a mild type of malarial fever, during autumn, along the river swamps. The upland swamps not being subject to overflow, and resting on sand, are not troubled with these complaints. The seasons most favorable for cotton are those in which there is a dry, cold winter to facilitate the preparation of the land; light showers in April to insure germination; a dry and warm May and June, not only to render the destruction of the grass easy, but, as the cotton planters term it, to "cook the cotton-plant", hot weather, and even drought at this stage of growth, increasing its productiveness; in July and August hot and seasonable showers to keep up the strength of the plant and promote fructification; and a dry fall for picking. The length of time between the latest frost in the spring and the earliest frost in autumn has an important bearing on the crop.

Although the planting of cotton during these years was sometimes completed as early as the 30th of March, irreparable injury to the stand was only inflicted once, in 1849, when snow fell on the 15th of April, and was succeeded by cold weather. Nor do the autumn frosts always destroy the plant completely; blossoms at Christmas and New Year are not unfrequently seen, and there are occasionally winters of such mildness that the old cotton roots throw out fresh shoots in the spring; and there are rare instances where fields lying out have thus borne a crop the second year that was worth gathering.

SOILS.—The upper pine belt contains something over 6,000 square miles, about one-sixth of which is swamp and the remainder uplands. The uplands consist of a fine, light gray, sandy loam, resting on a subsoil of red or yellow clay. In the east, in Marlborough and Marion, the clay is usually found at only from 3 to 4 inches. In the west it is often deeper, and a subsoil of yellow or red sand intervenes between it and the surface soil; even here the depth to clay is seldom as much as 2 feet.

The following are the analyses of these soils, made for the Tenth Census:

No. 3. *Sandy soil*, cultivated; field of C. S. McCall, near Bennettsville, Marlborough county; taken 12 inches; original growth, long-leaf pine, with undergrowth of oak and dogwood; has been planted for two or three generations; yield for several years past, one bale of cotton per acre.

No. 7. *Sandy mulatto soil*, cultivated; taken from Governor Hagood's plantation near Barnwell Court House; original growth, long-leaf pine, with oak and hickory undergrowth; yield, 764 pounds seed-cotton, average for ten years on 140 acres.

No. 8. *Sandy soil*, cultivated, taken near the Savannah river, from the Johnson field on the Cathwood plantation of P. F. Hammond, in Aiken county, the soil being taken uniformly to the depth of 12 inches. The original growth was long-leaf pine, with an undergrowth of post oak and black-jack runners. The land was cleared in 1835, and has been planted continuously in cotton for the last thirteen years, yielding an average of from 1,000 to 1,200 pounds seed-cotton on 200 acres, the cotton being a long-staple variety of uplands, selling for 2 to 5 cents per pound above ordinary uplands, and not very prolific.

No. 9. *Virgin forest soil* from red clay ridge near Marion and Marlborough line, on the Donohoe plantation of W. D. Johnson; growth, large hickory, oak, and pine; similar land under present culture averages, for large fields, a bale of cotton to the acre one year with another, when planted for a succession of years in the same crop.

Soils of the upper pine belt.

	CULTIVATED SOILS.			VIRGIN SOIL.
	Marlborough county.	Barnwell county.	Aiken county.	Marion county.
	No. 3.	No. 7.	No. 8.	No. 9.
Insoluble matter	96.000	91.230	93.695	84.754
Soluble silica	0.950 } 96.950	2.489 } 93.719	1.483 } 95.178	4.435 } 89.189
Potash	0.040	0.092	0.076	0.192
Soda	0.027	0.047	0.060	0.069
Lime	0.052	0.091	0.114	0.068
Magnesia	0.060	0.046	0.202	0.294
Brown oxide of manganese	0.023	0.105	0.020	0.036
Peroxide of iron	0.564	0.760	0.787	1.997
Alumina	0.441	2.480	1.846	4.854
Phosphoric acid	0.064	0.159	0.036	0.022
Sulphuric acid	0.063	0.160	0.106	0.236
Water and organic matter	1.561	3.091	1.771	3.312
	99.845	100.700	100.146	100.269
Hygroscopic moisture	1.441	2.245	2.512	4.518
absorbed at	28 C.°	25 C.°	14.5 C.°	14.5 C.°

[According to these analyses, these soils are of a very light character, especially as regards Nos. 3, 7, and 8, in which, also, potash is quite low; and in 3 and 8, as well as in 9, phosphoric acid is deficient. Their fair productiveness, as stated in the text, must be due to the nature of the subsoil, of which no specimens were furnished for analysis. Doubtless the duration of productiveness will be found sensibly proportional to the closeness of the red clay subsoil to the inferior surface soil. The moisture coefficient of Nos. 3 and 7 is also very low, rendering them subject to drought unless quite deeply tilled, so as to intermingle them with the more retentive subsoil. Deep culture is, therefore, to be especially recommended, and phosphate fertilizers will be first needed in Nos. 7, 8, and 9.—E. W. H.]

The following analyses were made by Professor Shepard, and were published in *Tuomey's Agricultural Survey of South Carolina*, in 1848:

No. 14. *Cultivated soil* from the cotton lands south of Columbia, Richland county.

No. 15. *Cultivated soil*, taken near Bennettsville, Marlborough county.

Cultivated cotton lands of Pedee river.

	RICHLAND COUNTY.	MARLBOROUGH COUNTY.
	Soil.	Soil.
	No. 14.	No. 15.
Insoluble residue	76.50	77.30
Potash and soda	Trace.	0.00
Lime	1.00	0.80
Magnesia	0.50	1.00
Iron	2.40	5.00
Alumina	6.60	4.80
Organic matter	9.00	5.40
Water and loss	4.00	5.70
Total	100.00	100.00

[Little can be learned from these analyses, except that the soils are moderately clayey and retentive and contain a high percentage of lime, a notable advantage over the upland soils, and rarely unaccompanied by an adequate supply of other ingredients of plant food.—E. W. H.]

including corn, small grain, and rice; 169,796 acres are in fallow, and in other crops. As fallowing is not regularly practiced in the husbandry here pursued, and as the other crops include only sugar-cane, potatoes, orchards and gardens, almost exclusively for local use, and consequently small, this figure includes some of the corn lands whose culture has been so largely abandoned.

The *farms* number 19,649, averaging nearly 50 acres of tilled land to the farm, which is the largest average in the state. Their relation, however, to the population remains about the same as in the regions south of this, viz, one farm to 12½ of the population; northward, the number of farms increase in proportion to the population.

The production of cotton in 1879 was 148,050 bales against 83,210 in 1869, an increase of 70 per cent., and comprises 28 per cent. of the total production for the state. The average yield per capita is 981 pounds of seed-cotton, the largest, except in the comparatively small red-hill region, where it is 1,044 pounds. The yield per acre is 606 pounds seed-cotton, which is also larger than elsewhere, except for the small crop of the lower pine belt. In Marlborough county the yield per acre averages 828 pounds seed-cotton, and the yield per capita 1,608 pounds. This is the maximum product in the state, and entitles the region to its designation as the central cotton belt of Carolina.

The grain crop is 3,631,302 bushels, an increase of 1,500,000 bushels on the returns of 1870. This includes corn, small grain, and rice, and constitutes 21 per cent. of the grain crop of the state. The average is 16 bushels per capita of the population, and 8.6 bushels per acre. Allowing 80 bushels a year to the head of work stock, the 35,469 head in this region would leave less than 800,000 bushels for the population, 3½ bushels per capita with nothing for the other live stock. The maximum average product is attained in Marlborough, 10¼ bushels per acre, 20½ bushels per capita of population.

The live stock number 313,811, which is an average of 1 to every 9 acres, 16 to each farm, 1.4 head to each one of the population, 2 to the bale of cotton, and 1 to every 11 bushels grain produced.

RED-HILLS REGION.

The very gentle ascent of the upper pine belt attains on its northern margin an elevation of from 200 to 250 feet above the sea-level, and an irregular and interrupted line of hills is then encountered. These hills rise 200 or 300 feet above the plain south of them, and this greater elevation is not unfrequently reached in traversing a few hundred yards. From their tops extended views of the gentle and regular slope of the "lower country" are exposed to the south and east. To the north and west a sort of table-land, broken on the streams, stretches back, gradually thinning out on the higher and more rolling sand-hill region of the state.

The general trend of these hills corresponds pretty nearly with that of the other regions of the state, being northeast and southwest. Starting above Hamburg, on the Savannah river, they sweep northward and eastward across the western part of Aiken and the northern part of Barnwell county. Following the northern line of Orangeburgh county they attain their greatest breadth on the Santee river just below the junction of the Congaree and Wateree rivers. West of the Santee river their course is more northerly, and they form here that remarkable line of hills traversing Sumter county long known as the "high hills of Santee".

While the red hills form a well-marked belt across the state below the sand hills proper, from the western part of Aiken to the northeastern corner of Sumter county, they are not continuous, but are interrupted at greater or less intervals by the intrusion of the sand hills from above. Mills' description of the high hills of Santee gives a clear idea of this. He says:

> They take their rise about 9 miles north of Nelson's ferry (on the Santee river) and form that fine body of "brick mould" land in the Richardson settlement. After continuing about 8 miles they suddenly become sand hills. At the end of 11 miles they become red land again, which continues to Buck creek, above Statesburg (9 miles). These hills up to this point appear to hang over the Wateree swamp; but now they diverge and turn to the northeast, with one ridge in the middle forming a backbone, breaking off into steep hills toward the Wateree and sloping off gradually toward Black river. At Buck creek the hills again become sandy, which gradually increases to Bradford springs (15 or 16 miles). A little above this place they join the sand hills of the "middle country".

The ridge lands along the southern line of Edgefield county have been included in this region; for although they lie above the lower outcropping of the granitic rocks and between these and the clay slates on the north, they so closely resemble the red lands, here mentioned, in soil, growth, elevation, and physical features generally, that the same description will cover both.

TIMBER GROWTH.—The long-leaf pine thins out on these hills, and is even replaced sometimes by short-leaf pine of large growth. The characteristic timber growth, however, is large oak and hickory. All the oaks of this section attain here an unusual size, including the post and the black-jack, but the red oak surpasses them all, measuring sometimes as much as 7 feet in diameter, while trees 4 and 5 feet through are not uncommon.

CLIMATE.—The differences between the climate of the red hills and of the region south of them is due almost entirely to the difference of elevation. Being from 200 to 300 feet higher, they enjoy a drier, more bracing, and in some regards a warmer atmosphere. While these heights are not more subject to the severer influence of storm-winds than the surrounding country, the ordinary movements of the air are more constant and perceptible there than elsewhere. During the extreme heats of summer there is scarcely a night when these hills are not visited by refreshing south winds. In ascending them in the cool evenings of autumn, at a certain point you pass suddenly from a cold air into one several degrees warmer, the difference being strikingly perceptible.

Killing frosts are generally a week or two later in fall, and not so late by the same period in spring as in the plain below. These advantages made this region at one time famous for its fruits. The long-staple sea-island cotton has been tried here and found to mature well, and it is not improbable that with the same nice care and attention that is given to this crop on the sea islands it might be successfully grown here. Such was Governor Seabrook's opinion. These hills, and especially the high hills of Santee, were formerly much frequented by planters from all parts of Carolina, and even of other southern states, as health resorts during the summer months. The whole region is remarkably healthy and free from epidemics of all sorts. During the severest winter of the last half century, the banana and the sago palm, standing in the open ground and protected by only a few handfuls of cottonseed around their roots, though killed down, preserved sufficient vitality to throw up vigorous shoots in the ensuing spring.

SOILS.—The soils of this region are yellowish red loams, similar in appearance to the mulatto soils derived from the hornblende rocks in the "upper country," but not so tenacious or waxy. They become hard in dry weather, but in wet weather, owing to the amount of sand they contain, the intervals when they cannot be worked are short. Vegetable matter rots rapidly in them, and for this reason long manures from the stable and barn-yard are better adapted to them than commercial fertilizers, which latter (especially the ammoniated guano) pay better on the sandy soils. Stable manure is well retained by these soils, and they are capable of great improvement by its use. Worked without manure the soils rapidly become unproductive.

The following analyses of typical soils in this region were made for the Census Office:

No. 1. *Virgin soil of red lands*, from the table-land on the place of J. Peterkin, 3 miles below the junction of the Wateree and Congaree rivers, Orangeburgh county; taken 12 inches deep; timber growth, large red oak, hickory, dogwood, and a few very large short-leaf pines.

No. 2. *Soil of the red lands*, near the above. It has been cultivated more than 100 years, having been an old Indian field. It contains 375 acres, and in 1879 produced 250 bales of cotton. When the sample of soil was taken there was a crop on it estimated at 1,200 pounds of seed-cotton to the acre. The field had only received cottonseed and some commercial fertilizer as manure for a number of years previously.

Red lands soils.

	ORANGEBURGH COUNTY.	
	Virgin soil.	Soil cultivated 100 years (fertilized).
	No. 1.	No. 2.
Insoluble matter	88.960	89.340
Soluble silica	3.055	2.847
	92.015	92.187
Potash	0.115	0.138
Soda	0.050	0.063
Lime	0.062	0.077
Magnesia	0.028	0.061
Brown oxide of manganese	0.098	0.096
Peroxide of iron	1.250	1.559
Alumina	3.979	3.666
Phosphoric acid	0.096	0.087
Sulphuric acid	0.047	0.038
Water and organic matter	2.621	1.668
Total	100.361	99.640
Hygroscopic moisture	1.982	1.444
absorbed at	26.6 C.°	26.6 C.°

The following analyses have been taken from Professor Tuomey's report of the survey of South Carolina, published in 1848:

No. 18. *Red soil* from near Orangeburgh village, about the line of junction of the buhr-stone and Santee marls, Orangeburgh county.

No. 19. *Red soil* from Lang Syne, near Fort Motte, Orangeburgh county.

No. 20. *Red soil* from the high hills of Santee, near Statesburg, Sumter county.

	ORANGEBURGH COUNTY.		SUMTER COUNTY?
	Soil.	Soil.	Soil.
	No. 18.	No. 19.	No. 20.
Insoluble residue and silica	66.90	71.00	80.30
Potash and soda	Trace.	0.50	
Lime	2.00	1.56	0.90
Magnesia	0.50	1.00	Trace.
Oxide of iron	6.00	4.00	3.70
Alumina	9.60	8.50	6.60
Phosphoric acid			
Organic matter	5.60	7.00	4.40
Water and loss	9.40	6.44	4.10
Total	100.00	100.00	100.00

[These two sets of analyses exhibit wide differences in the composition of the soils of the region. The prominence of lime in Nos. 18, 19, and 20 furnish a presumption of high and permanent productiveness, while Nos. 1 and 2 would appear very much inferior in both respects, and their productiveness is probably due to their subsoils.—E. W. H.]

STATISTICS.—The red-hills region contains about 1,620 square miles, and has a population of 44,816, being 27.6 persons to the square mile; 56 per cent. are colored. The area of tilled land is 234,682 acres, being 144 acres per square mile, or 22 per cent. of the entire surface, and 5 acres per capita of the population. The number of farms is 4,568, being 2.8 per square mile, a farm to every 10 persons, averaging 228 acres, 50 of which is under cultivation to the farm, the remaining 178 acres being uncleared, and for the most part yielding no return whatever. The crops are cotton, corn, and small grain. Cotton, in which 84,939 acres were planted in 1879, yielded 34,249 bales. The average yield per acre was 192 pounds lint, and per capita 363 pounds lint, the largest yield per capita of any region of the state. This is a little more than 6 per cent. of the whole area planted in cotton in the state, and the yield 6.6 per cent. the total yield of the state. In grain of all kinds 114,425 acres were planted, yielding 804,443 bushels, a little over 7 bushels per acre and 17 bushels per capita of the population. This area is a little over 6 per cent. of the total area planted in grain in the state, and the crop is $4\frac{7}{10}$ of the crop of the state. This yield is wholly disproportionate to the capabilities of the soil, which is particularly adapted to small grain. Rice, the most productive grain crop in the state, is little planted, and this in part accounts for the falling off; but lands which in 1825 (see Mills, p. 660) made an average of from 8 to 12 bushels, and when manured 34 bushels of wheat to the acre, and an average of from 10 to 25 bushels of corn to the acre, and still more when sown in rye and oats, are far below their normal production when yielding as above indicated. In other crops and fallow there are 35,318 acres, nearly 15 per cent. of the tilled land. The culture of much of this land is abandoned as a consequence of the disaster, incident to the late war, to the rich planters who formerly lived here.

The work stock numbers 7,663, not quite 5 to the square mile; 1 to every 30 acres of tilled land, and 1 to every 6 of the population.

The live stock is 61,569, chiefly hogs; being 38 to the square mile, and nearly 1 to every 4 acres of cultivated land. The larger portion of them are the property of persons owning no land and planting little grain. They are thus almost wholly dependent for subsistence on the range, or on depredations on the growing crops, and yield little in meat or manure in return. It yet remains to organize a stock husbandry for this as well as for most other sections of the state.

THE SAND-HILLS REGION.

The belt of sand hills stretches across the state from a point opposite Augusta, Georgia, to the intersection of the North Carolina line by the great Pedee river. The average distance of its lower border from the sea is 95 miles. Its length is 155 miles; its width is variable, the maximum in Lexington county being 30 miles, and the average about 20 miles. In the central part of the state, along the Congaree river, the granite rocks on which Columbia stands, outcrop down the stream until they touch the broad flats of the upper pine belt that extend out from the eastern bank, so that at this point the sand hills disappear, and the region is divided into an eastern and a western portion. It occupies the larger portion of the five central counties of the state, viz, Aiken, Lexington, Richland, Kershaw, and Chesterfield. Sand hills, similar in every respect to the typical sand hills of this region, appear in restricted localities in several other parts of the state, as in Barnwell and Clarendon counties, and, what is more remarkable, among the rocky hills of the "upper country", as in Lancaster and Abbeville. In the latter county, near Dorn's gold mine, there is, for instance, a tract of sand-hill land not more than six acres in extent, where the coarse white sand supports the characteristic growth of long-leaf pine and forked-leaf black-jack oak, no specimen of which is to be met with in a day's ride of 40 or more miles in any direction from this spot.

SURFACE FEATURES.—The surface features of the region are of a monotony aptly characterized by the term "pine barren" which is applied to it. The sand hills rising from the Savannah river attain at the village of Aiken an elevation of 600 feet above the sea, and there is a slight incline to the valley of the South Edisto river. Between the two Edistos there is a high sand ridge. Beyond the North Edisto a gradual ascent is resumed, until an elevation exceeding 700 feet is reached in Platt Springs township, in eastern Lexington. Hence there is a rapid descent of more than 500 feet to the Congaree river. East of the Congaree the rise is again gradual, and the maximum elevation is attained on the further border of Richland county, where the hills once more descend abruptly to the Wateree river. Beyond this river there are no data as to levels, except that on the water-shed of the Great Pedee river there is evidence that the surface has suffered denudation to the depth of 150 feet or more. This evidence is furnished by a small conical hill, known as Sugar-Loaf mountain, rising in central Chesterfield, 150 feet above the surrounding country. The hill is composed of strata of sand and kaolin, similar to the general sand-hill formation, and has been preserved from denudation by blocks of ferruginous sandstone covering its top and sides, identical in character with the same sandstone found on the surface at many places among the sand hills.

As already stated elsewhere, the long slopes face southwest, and the short slopes face northeast, and, in general, the elevation of the western portion of the state is greater than the eastern. The spring branches, and even streams of considerable size, sink into the sands of this region and are lost or reappear at distant points in the form of springs, called "boiling springs", which issue from the earth with considerable force, throwing out no inconsiderable amount of fine sand to be conveyed onward by the streams. It is to the undermining action thus carried on by these underground drains that Professor Tuomey attributed the occurrence of numerous circular depressions of the surface, met with on the elevated flats of this region and holding ponds of water during a considerable part of the year. Another curious phenomenon, doubtless connected with these streams, is, that where wells have been bored through these loose sands, sometimes to a depth much exceeding 100 feet before reaching water, it has been found that a current of air ascends from the well. This current varies in force, and in one well of six-inch bore at Mr. R. H. Hankinson's, in Aiken county, it would blow with such force for some hours previous to a storm, as to be heard at a distance of several yards, and was able to throw a felt hat, placed over the orifice, with some force into the air. But notwithstanding the great dryness of these pine barrens, they are well watered, being crossed by seven rivers of considerable size, having an aggregate length of more than 200 miles among the hills. Of creeks, not counting smaller streams and branches, there is an aggregate length of 1,200 miles capable of furnishing abundant water-power. For instance, Horse creek, an average stream out of 78 of like character, furnishes in the single township of Gregg, in Aiken county, motive power for three large cotton factories, besides a large paper-mill and other mills, aggregating 1,150 horse-power, and moving 46,720 spindles without having its entire capacity employed. The waters of these creeks are of great purity, being as clear and sweet as the best spring water. On the margins of these streams there are more than 100,000 acres of bottom lands, for the most part uncleared, but capable of being rendered productive in the highest degree by drainage and irrigation.

Timber growth.—The long-leaf pine here attains its highest perfection, trees 6 and 7 feet in circumference being of not unusual occurrence. The wood is also of better quality, having less sap and more heart, the latter being more resinous than elsewhere, and the names of creeks, springs, and neighborhoods are often derived from it, as "lightwood", "lightwood-knot," referring to its valuable qualities as fuel. But even this tree becomes stunted on the higher and finer sand ridges and gives its place to the New Jersey tea-plant (*Ceanothus americanus*), which alone covers the dazzling whiteness of the sand. There is an undergrowth of forked-leaf black-jack oak, and, wherever there is any underlying clay or suspicion of moisture, of the round-leaf black-jack oak. The annual fires check this growth, which would otherwise successfully contest the soil with the pine and thereby add largely to its fertility. The juniper is abundant in some localities, and is manufactured into buckets and tubs. On the hillsides, where there is an outcropping of pipe clay, masses of kalmia add a pleasing variety to the monotony of the pine growth.

CLIMATE.—The climate of the sand hills is dry, tonic, sunny, and stimulating, and entirely free from malarial influences. The region has long been a notable health resort during winter for consumptives from northern

latitudes, and during summer for persons from the lower country seeking fresher and purer air, free from every taint of malaria. The inhabitants themselves enjoy an unusual degree of health, and cases of longevity are common. The death rate is low; *e. g.*, in Platt Springs township, Lexington county, in a population of 853, there were two deaths in 1879, and in 1880, four deaths, three of which were of persons over eighty years of age.

The mean annual temperature is 62.50° F.; the winter mean, 48.53° F.; the spring mean, 55° F.; the summer mean, 75° F.; the autumn mean, 71°; but excluding August (the hottest month of the year), the mean for autumn, *i. e.*, for September and October, is 68° F. The average diurnal range of temperatures is 12.65° F., and unsurpassed in point of equability by any of the important health resorts in the United States, except San Diego, California. Frosts may be considered as over after the middle of March, though sometimes a straggling frost has taken vegetation by surprise even as late as the 26th of April. The period of the year without frost has an average duration of from 200 to 225 days, and even during mid-winter frosts are not of frequent occurrence.

The elevation, and the porous subsoil of land, in which water rests only at a depth of from 80 to 150 feet, renders this a remarkably dry climate. Steel instruments may be exposed for months without rusting, matches left open never miss fire, moth and mold are rarely seen, and the Cryptogamous plants are feebly represented. Observations at Aiken show that the relative humidity of the air is 64.04 per cent., being less than at any of the celebrated health resorts of Europe, Hyeres and Cannes excepted. Heavy dews never occur; fogs are still rarer. The number of days on which rain falls varies from 29 to 45; of the remainder, from 216 to 239 are clear, leaving from 84 to 107 days as cloudy or partially cloudy.

During sixteen years the rainfall at Aiken averaged 46.70 inches, varying from 33.87 to 56.49 inches. The average fall in winter is 9.02 inches; in spring, 14.44 inches. The heaviest monthly rainfall of the year—viz, 6.04 inches—occurs in April, which usually has a larger proportion of bright clear weather than any other period. In summer the average rainfall is 12.23 inches; in the fall, 10.79 inches. During five years six falls of snow were recorded, but as a rule there were only a few flakes, that melted on touching the earth. Sleet is more frequent than snow, but disappears on a few hours' exposure to the sun.

The prevailing winds are from the south and southwest. The drinking-water, filtered through great thicknesses of sand, is transparently clear and of exceptional purity. The temperature of wells and springs varies from 62° to 64° F. (*Climate and Topography of Aiken*, E. S. Gaillard, M. D., Richmond, Va.; and *Aiken as a Health Station*, by W. H. Geddings, M. D.)

It must be remembered that this description applies to no restricted locality, but refers to an area of more than 2,000 square miles, where the sanitary conditions alluded to are present with the healing and terebinthinate odors of the great pine forest.

SOILS.—The characteristic ingredient of the soil of this region is the loose rounded sand which forms its chief constituent, and which sometimes reaches to a depth of from 100 to 150 feet without change, as shown in wells. Subsoils of yellow sand are frequently met, and on the hillsides there are outcrops of clay, white or mottled and variegated in color, the hues ranging through yellow, buff, red, and purple. There are hills of sand of great fineness and exceeding whiteness and purity, but generally the sand is coarse; the ridges and hilltops are very barren. The high flats are more productive, and the less elevated flats are often quite productive, being cultivated with great ease, and "continuing to produce as long as there is a particle left of anything that can sustain a plant".—(*Tuomey*). The organic matter in the surface soil consists largely of minute fragments of charcoal, a residuum of the pine straw (leaves) left by the forest fires, which it is still the bad practice to set out yearly, in order to sweep off all undergrowth for the sake of the very scanty pasturage upon which the stock, ranging at large, subsists.

The following analyses of these soils were made by Professor C. U. Shepard, sr., in 1846:

No. 21. *Virgin sandy soil* from near Aiken, Aiken county.

No. 22. *Sandy subsoil* of No. 21.

No. 23. *Cultivated sandy soil* from Platt Springs, Lexington county.

Soils of the sand-hills region.

	AIKEN COUNTY.		LEXINGTON COUNTY.
	Soil.	Subsoil.	Soil.
	No. 21.	No. 22.	No. 23.
Insoluble residue and silica	77.000	81.000	80.000
Lime	0.050	0.400	0.600
Magnesia	Trace.	Trace.	Trace.
Oxide of iron	4.005	3.500	3.000
Alumina	5.000	5.500	5.600
Phosphates	Trace.	.....	Trace.
Organic matter	8.500	.....	6.500
Water and loss	5.500	9.600	4.300
Total	100.055	100.000	100.000

[These analyses seem to show a soil extremely poor in the ingredients of plant food, but redeemed from sterility by relatively large supplies of lime and organic matter. Their proportion of clay also seems to be larger than is indicated by the description, thus rendering them remarkably retentive.—E. W. H.]

per annum he reckons his stock to consist of 400 heifers, 500 cows, and 300 steers—1,500 head in all, besides horses."—(*Philosphico Historico Hydrogeography of South Carolina*, 1771). Davyd Ingram wrote of these regions, 1568–'69: "There is alsoe great plentye of Buffes, beares, horses, Kyne, wolves, foxes, deare, goates, sheepe, hares, and conyes; the moste pte beinge wylde, the Hydes & Skinnes of them are good mchaundize."

What has been said in regard to the general management of the soil, and the culture of crops, and the wages of labor in the upper pine belt applies to the sand-hills region. The only noteworthy difference here is that agriculture is more self-sustaining, fewer supplies are purchased, the lien business is very small, less land is rented, and more of it is cultivated by the proprietors of the soil, the field work to a large extent being done by them. The population is simple, frugal, healthy, and industrious, and are more employed in small handicraft than elsewhere. The region, although crossing the central portion of the state, is not traversed by any of the lines of railway, and retains unaltered much of its primitive customs and methods.

THE METAMORPHIC REGION.

The metamorphic region of South Carolina coincides very nearly with what is known as the "upper country" of the state. It includes the whole of the eight counties of Abbeville, Anderson, Newberry, Laurens, Union, Fairfield, Chester, and Lancaster, and also embraces the northern portion of Edgefield and Lexington and the northwestern portions of Richland, Kershaw, and Chesterfield. The southern parts of Oconee and Pickens, and the southern and larger portions of Greenville, Spartanburgh, and York are within its limits. A line drawn from a point on the Savannah river, 3 miles above Hamburg, to Columbia, and curving thence northeast to where the Great Pedee river crosses from North Carolina into South Carolina, defines in a general way its southern border. Its northern boundary follows in the main the direction of the Atlanta and Charlotte Air-Line railroad, which lies in the Piedmont region just north of the one under consideration.

SURFACE FEATURES.—The surface features of this division of the state, however, entitle it to the name of the Piedmont region. Its rocks are so similar to those of the Blue Ridge mountains, that though they have been broken down, leveled off, and worn away by exposure, during countless ages, through the vicissitudes of the seasons, they are and always have been the foot hills of the Appalachian range; while the broken and mountainous region to the north usually spoken of as the Piedmont country might be better called the Alpine or sub-Alpine region of the state.

The elevation of 31 points in the metamorphic region, varying from a minimum of 179.5 feet on the granite rocks at the Congaree bridge, below Columbia, to a maximum of 880 feet at Belton, on the Greenville railroad, give a mean elevation above the sea of 590 feet. The mean elevation of the Columbia and Augusta railroad, where it passes along the southern border of the region, is 575 feet; that of the Air-Line railroad, in South Carolina, lying to the north of it, and almost wholly within the Piedmont region, is 910 feet. Between these two lines, therefore, a distance of some 90 miles, there is a general rise of the surface of 335 feet, or less than 4 feet to the mile. This is a gentler slope than that of the Tertiary plain or low country, the distance from the sea to its northern border being about 100 miles, and the difference in elevation something more than 500 feet, or over 5 feet to the mile.

The face of the country presents a gently undulating plain, which becomes more rolling as it approaches the rivers and larger streams, and is finally hilly and broken above the bottoms and narrow low grounds, through which the numerous water-courses find their passage.

The Savannah river, on the western boundary of the state, passes through the metamorphic rocks for more than 100 miles, and although it receives many affluents, and some of them quite large, on its eastern bank, they join it at such an acute angle as to make its eastern water-shed very narrow, scarcely anywhere exceeding 20 miles in width. In the eastern part of the state Lynch's river passes through this region for about 12 miles, its western water-shed not exceeding 5 miles. Between these two narrow water-sheds in the east and west there is an interval of about 100 miles. The numerous streams traversing this interval belong to one river system, and unite shortly after entering the Tertiary plain to form the Santee river, which has been called the river of South Carolina.

TIMBER GROWTH.—Remarkable changes have occurred in the timber growth of the "upper country" since its settlement during the middle and earlier part of the eighteenth century. The "long drawn beautiful valleys and glorious highlands", spoken of by Lord Cornwallis, were then interspersed with "forests, prairies, and vast brakes of cane, the latter often stretching in unbroken lines of evergreen for hundreds of miles".—(*Logan.*) On the highlands the oak, hickory, and chestnut were of large growth, standing so wide apart that a buffalo or a deer could be seen by the pioneer hunters for a long distance. There was no underbrush, and "the woodlands were carpeted with grass and the wild pea-vine, the latter growing as high as a horse's back. The cane growth was the standard by which the early settlers estimated the value of the land. If it grew only to the height of a man's head the land was esteemed ordinary, but a growth of 20 or 30 feet indicated the highest fertility. This cane growth not only filled the bottoms, but extended up the slopes to the tops of the highest hills. Thus it was designed to place the

first house built on the present site of the town of Abbeville on the summit of the hill, but afterward, when the tall cane that covered the whole place was cleared away, an error of more than 50 yards was discovered". The trappean soils around Ninety-six, the "flat-woods" of Abbeville, the meadow-woods of Union, and the black-jack lands of York and Chester were prairies with no growth of trees, but covered for the most part with maiden cane. Upper Carolina was then not inferior to any portion of the great west as a grazing country. Buffalo and deer in great numbers roamed through these luxuriant pastures. Henry Foster, a pioneer settler on the Saluda, in Edgefield, counted one hundred buffalo grazing at one time on a single acre of ground in Abbeville county. The original forest has disappeared almost altogether, and has been replaced by younger oaks of small growth, by underbrush, and by the loblolly pines of the abandoned fields. The cane has gone likewise. The wild pea-vine is no longer known, though since the stock has been penned under the new fence law a plant, supposed to be this pea-vine, has appeared in the open woodlands, with several grasses not observed before. The prairies have become covered with a growth of heavy-bodied post and black-jack oaks; the latter in turn is now giving place to the cedar in Chester. The chestnut has been dying out for fifty years; in some localities where it once flourished it has entirely gone, and in others large dead stems and stumps are the only vestige of this valuable and stately tree. The chincapin and the chestnut-oak are also sickening and dying. During some years past somewhat similar symptoms of disease have appeared in the red and black oak, and fears on their account have been entertained.

The distinctive growth of the region is the short-leaf pine, with a large variety of oaks and hickories. On the water-courses willow, beech, birch, black walnut, ash, poplar, and gum abound. The sycamore sometimes attains a great size, one in York being 28 feet in girth; the tulip tree also is often very large. The sugar maple is found, and another maple of larger growth, and yielding a superior sugar, as to both quantity and quality, is known in Lancaster under the name of sugar tree.

CLIMATE.—The shorter seasons and lower temperatures of the metamorphic region, as compared with those lying immediately south of it, are but slightly attributable to differences of elevation or of latitude, these differences being themselves slight. They result perhaps from greater nearness to the mountains, and, as affecting agriculture, still more perhaps from the heavier clay soils and subsoils, which are more retentive of moisture, and are therefore colder and later in spring than the lighter sandy loams of the lower country. Cotton planting is about ten days later than in the upper pine belt; cotton also blooms later, but by a shorter period, and the same is true of the opening and picking season of the plant, showing that with a later start it grows faster, passing more rapidly through its various stages to maturity. Killing frost occurs from the 15th of October to the 1st of December. This region, however, does not seem to be much affected by that variability of temperature common to localities in proximity with mountain ranges. This is shown by the singular exemption of certain localities here from the injurious effects of late spring frosts. Thus on Rich Hill, a ridge 6 miles broad, between the Pacolett and Fair Forest rivers, in Pacolett township, Spartanburgh county, fruit has been injured by late frosts but once in forty years. Localities in Union also enjoy this immunity in nearly the same degree. In the absence of other records some idea of the temperature may be formed by observations on the temperatures of springs, assuming that this temperature approximates the annual mean. Lieber states as the result of a number of observations that the springs of the Piedmont region have a temperature of from 55° to 58° F., those on a line passing through the center of the metamorphic region one of from 58° to 61.5° F., and below this line one of from 61.5° to 66° F. The only accessible records of rainfall are those published by the Smithsonian Institution, May, 1881. They give an average annual rainfall in this region of 52.34 inches, varying from 44.05 to 60.12 inches. This gives a greater annual rainfall for this region than for those south of it, and places it in this regard next to the areas of greatest annual precipitation in the United States. The spring rains vary from 12 to 15 inches, and in this regard it holds the same relations as in the former to the regions south of it and to the United States. The summer rains are from 10 to 14 inches less than in the regions south of it, and third or midway between the areas of greatest and of least summer precipitation in the United States. The autumn rains are from 8 to 10 inches, and in the counties east of Broad river they are from 10 to 12 inches, being about the same as in the regions to the south, and midway between the areas of greatest and least autumn precipitation in the United States. The winter rains are from 10 to 14 inches, something more than in the lower country, and a little above midway between the areas of greatest and of least winter precipitation in the United States. For the whole year, and in each season of the year, the rainfall is less than in the Piedmont or alpine region north of it. It has been thought that the synclinal axis, running northeast near Allston on the Greenville railroad, has been, during some years past, a line of demarkation between areas suffering from drought to the south of it and those having seasonable rains to the north of it, the first occupying surfaces under which the rocks dip northwest, and the latter one under which they dip southeast.

In point of healthfulness this region leaves little to be desired. When first settled the country was entirely free from all malarial influences. Subsequently, during the period when the first clearing of the forests was in active progress, the hitherto clean bordered channels of the streams became obstructed, in part with fallen timber and brush from the clearings, and in part by the washings of the hillsides. Under the injudicious use of the plow these washings occurred to such an extent as to alter the original level of the surface and to pile the dirt up around the trees in the bottoms until they were killed. This was attended by the prevalence of malarial fevers. Later, the uplands having been cleared and partly exhausted, attention was directed to the drainage and reclaiming of

the low grounds for agricultural purposes, and the healthfulness of the locality was restored. It has thus happened that with the extension of the settlements a belt of malarial influences has moved forward with them, vanishing below and advancing above until it reached the very mountains before disappearing.

SOILS.—The area of land in the metamorphic region, whose culture is impeded by the rocks prevalent there, is comparatively insignificant. This is due to the rather remarkable extent and depth of the disintegration of these rocks. It is a not uncommon occurrence that wells sunk through granite to a depth of 30 or 40 feet require for their excavation no other implement than a spade. Frequently so thorough is the decomposition that the sides of railroad cuts and of mines might be mistaken for a heap of transported materials, did not the existence of seams and quarry veins, which may be always traced on the fresh surfaces, make it certain that the rock had rotted where it stood. The chief impediments to culture are the masses of quartz rocks once forming these veins, but now scattered broadcast over the surface in consequence of the rotting and denudation of the strata that contained them. This is especially the case among the clay slates, and often the first indication which the traveler has that he has entered the metamorphic region is the sight of fields and woods covered with angular fragments of these white quartz rocks. The inclination of the country rocks favors drainage along their edges, and even where the rock is near the surface water seldom collects above them to an injurious extent.

Owing to the frequent transportation and intermixture by mud of the *débris* from the different rocks, the areas of the soils derived from each can be characterized with much less distinctness than the areas occupied by the underlying rocks themselves. Nevertheless these leading varieties of soil may be traced with much clearness, viz, the granitic, the clay slate, and the trappean soils.

Granitic lands.

The granitic soils occupy by far the largest area, as under this head is comprised the soils whose substratum is granite and gneiss, and also those resting on the hornblende talc and mica-schists. These soils are characterized by two distinct names: 1st, the gray sandy soils; 2d, the red-clay soils.

The *gray sandy soils* occupy the ridges and levels, and have been formed by the gradual separation of the siliceous and argillaceous materials found in the *débris* of the decomposing rocks that underlie them. This has been effected by a process of lixiviation, during which the rainwater, not running off, owing to the level nature of the land, sank directly into the earth, carrying down with it the finer particles of the clay through the interstices of the larger particles of sand. This gives a light, loose, warm, sandy loam, varying in depth from 3 to 18 inches, and fine or coarse according to the grain of the rock from which it is derived. The subsoil is red or yellow clay. Such soils are of easy culture, respond readily to the use of commercial fertilizers, and are well adapted for cotton. For these reasons they are much more highly esteemed now than formerly. The following analyses of them are taken from Tuomey's report:

No. 24. *Gray sandy soil* from hills near Grindall shoals, Pinkney township, Union county.
No. 25. *Gray sandy soil* from Saluda, near Mely's ferry, Waterloo township, Laurens county.
No. 26. *Gray sandy soil* from Tumbling shoals, Sullivan township, Laurens county.
No. 27. *Gray sandy soil*, on Saluda, Donaldsville township, Abbeville county.

Gray sandy granitic lands.

	UNION COUNTY.	LAURENS COUNTY.		ABBEVILLE COUNTY.
	Soil.	Soil.	Soil.	Soil.
	No. 24.	No. 25.	No. 26.	No. 27.
Insoluble residue	84.30	80.00	80.00	83.00
Potash and soda	0.50	0.60	0.50	.....
Lime	0.50	.....	0.02	0.60
Magnesia	0.40	1.00	.....	0.75
Iron oxide	2.00	3.00	4.00	2.00
Alumina	5.80	7.40	7.00	5.40
Organic matter	3.62	2.60	3.00	1.20
Water and loss	2.88	5.40	5.48	7.05
Total	100.00	100.00	100.00	100.00

The *red clay loams* are the prevailing soils of the hilly and broken country, and occupy slopes of greater or less declivity. The washing of these hills is not so destructive of their fertility as it would have been if the soil were not formed from rocks rotting *in situ*, thus including at every depth all the varied elements of the parent rocks. Thus it happens here that the earth from the bottom of deep wells, usually barren elsewhere, has been found, when spread over the surface, to increase notably the fertility of fields. Gullied spots deprived of all humus

and every trace of organic matter are, of course, barren for a time, but even their nakedness is soon covered by the old-field pine and their thriftiness is restored. As might be expected, with the clearing of the lands and the washing down of the ridges, the amount of gray lands is diminishing and the amount of red lands is increasing. Tuomey gives the following analyses of these soils in his report:

No. 29. *Red-clay soil* from Liberty Hill, Kershaw county.

No. 30. *Red-clay soil* from Yorkville, York county.

No. 31. *Red-clay soil* from North of Pendleton, Anderson county.

Red-clay lands.

	KERSHAW COUNTY.	YORK COUNTY.	ANDERSON COUNTY.
	Soil.	Soil.	Soil.
	No. 29.	No. 30.	No. 31.
Insoluble matter	74.00	71.60	70.00
Potash and soda	Trace.	0.06	0.60
Lime	1.00	1.40	0.90
Magnesia	0.40	0.50	1.00
Iron oxide	3.50	3.70	2.40
Alumina	10.00	9.40	10.00
Organic matter	2.18	4.50	8.00
Water and loss	8.92	8.84	7.10
Total	100.00	100.00	100.00

The following analyses are of a soil and a subsoil of the same character, from near Spartanburgh, Spartanburgh county. They were collected by Professor W. C. Kerr, of North Carolina, and analyzed for the Census Office.

No. 10. *Yellowish red soil*, taken 5 inches deep; timber growth, post, white, and black oaks, short-leaf pine, and hickory.

No. 11. *Red-clay subsoil*, taken from 5 to 20 inches.

Red-clay lands of Spartanburgh.

	Soil.		Subsoil.	
	No. 10.		No. 11.	
Insoluble matter	77.860	79.650	43.740	49.610
Soluble silica	1.790		5.870	
Potash	0.092		0.214	
Soda	0.041		0.087	
Lime	0.036		0.003	
Magnesia	0.070		0.212	
Brown oxide of manganese	0.056		0.010	
Peroxide of iron	5.646		11.700	
Alumina	7.538		26.536	
Phosphoric acid	0.082		0.134	
Sulphuric acid	0.058		0.009	
Water and organic matter	6.167		11.660	
Total	99.436		100.175	
Hygroscopic moisture	4.685		11.210	
absorbed at	21.8 C.°		21.8 C.°	

[The wide discrepancies between the older and later analyses, here given, leaves their general character somewhat in doubt. While the former are indefinite as regards the important elements, potash and phosphoric acid, they show a very high lime percentage, always indicative of great thriftiness in granitic soils. In this respect the North Carolina soil shows the exact reverse, viz, a deficiency of lime with fair percentages of potash and phosphoric acid in the subsoil, which would seem to indicate a rather unthrifty soil. The extraordinary amounts of iron and alumina dissolved in this subsoil render it worthy of further investigation as to the form in which the alumina exists.—E. W. H.]

The *hornblendic soils* are a variety of these red clay soils derived from granite and gneiss rock traversed by seams of hornblende. They are dark in color and of a more brilliant red. They occur in Edgefield, about Horns

creek, and most extensively in Newberry, especially between the court-house and Asheford's ferry, extending thence into Fairfield. They form excellent cotton lands, and are well suited to the culture of all the grains. The following analyses of them are from Tuomey's *Geological Report:*

No. 32. *Red soil* from hornblende rock, Newberry county.

No. 33. *Red soil* from hornblende rocks, Monticello, Fairfield county.

Red hornblendic lands.

	NEWBERRY COUNTY.	FAIRFIELD COUNTY.
	Soil.	Soil.
	No. 32.	No. 33.
Insoluble matter	79.80	80.00
Potash and soda	0.06	0.80
Lime	0.04	1.00
Magnesia		0.50
Iron oxide	1.75	2.20
Alumina	5.20	6.80
Phosphoric acid		Trace.
Organic matter	6.20	7.00
Water and loss	7.45	2.70
Total	100.00	100.00

[The soil from Newberry county is probably very similar to soil No. 10 from North Carolina, in the preceding table, making allowance for the failure to determine the phosphoric acid in the older analysis. The Fairfield county soil, on the other hand, agrees more nearly with Nos. 29 to 31 in the large lime percentage.—E. W. H.]

The *mica slates*, where underlaid by, or alternate with gneiss, as in Abbeville, give rise to good soils. In most places, however, the slate contains lenticular quartz grains coated with mica, which being indestructible, occupy the surface as the rock disintegrates and give rise to poor soils.

Clay slate lands.

The sand of the talcose slate is "exceedingly fine and packs very closely". Says Lieber, in speaking of cleaning out a spring, "at a depth of 6 inches below the bed of the stream the sand was as dry as ashes, showing that the water had never penetrated to that depth, affording an explanation of the serious effects produced by drought in these parts."

Clay slates underlie a soil that is characterized as a cold gray soil, varying in color from gray to yellow and brown; the subsoil is for the most part of yellow clay, but sometimes it is reddish. These soils are better adapted for small grain, and more especially for oats than for cotton. They cover an extensive area in Edgefield county and reach along the nothern border of the Tertiary, thence to Chesterfield. The clay slate soils in the last named county contain less silica than those of Edgefield; instead of being gray they are reddish, and are altogether better soils. The following analyses are given in Tuomey's report:

No. 34. *Soil* from Stevens creek, Edgefield county.

No. 35. *Soil* from near the Saluda, Lexington county.

No. 36. *Soil* from north of Columbia, Richland county.

Soils from clay slates.

	EDGEFIELD COUNTY.	LEXINGTON COUNTY.	RICHLAND COUNTY.
	Soil.	Soil.	Soil.
	No. 34.	No. 35.	No. 36.
Insoluble matter	80.72	76.30	80.30
Potash and soda	Trace.	0.40	0.30
Lime	Trace.	1.00	0.50
Magnesia	0.05	0.50	Trace.
Iron oxide	1.60	2.00	2.40
Alumina	12.00	10.40	9.00
Organic matter	2.40	6.70	5.00
Water and loss	3.23	2.70	1.90
Total	100.00	100.00	100.00

Cultivated lands of the flatwoods.

	ABBEVILLE COUNTY.		UNION COUNTY.
	Cultivated soil.		Abandoned land.
	No. 37.	No. 38.	No. 39.
Insoluble matter	52.00	48.30	53.00
Potash and soda	0.40	0.90	Trace.
Lime	2.50	4.00	1.80
Magnesia	Trace.		0.50
Iron oxide	9.00	8.40	14.10
Alumina	22.10	19.36	19.30
Phosphate of lime		0.10	
Organic matter	9.20	10.05	3.40
Water and loss	4.80	8.89	7.90
Total	100.00	100.00	100.00

[These soils differ strikingly from those of the preceding table, both in the large percentages of alkalies and lime and in the extraordinary amounts of alumina dissolved in analysis. Coupled with the large amount of organic matter, these characters constitute them a strict analogue of the prairies of the west. The deficiency in phosphates is probably only apparent and due to imperfect methods of determination. The high iron percentage would tend to render these soils very unsafe if not well drained, an improvement of which their durability would seem to render them well worthy. Deep and thorough tillage are pre-eminently necessary to render their cultivation profitable. The apparent increase in iron in the abandoned land is probably due to the removal of the surface soil, the sample representing a more highly ferruginous subsoil.—E. W. H.]

These analyses are indicative of the chemical changes that affect the productiveness of these soils. The abandoned field in Union shows a great falling off in organic matter, lime, and potash, due to insufficient drainage and a shallow culture.

The large amount of lime in all these trappean soils will be noted; it has induced some writers to classify them as calcareous soils, and adapts them peculiarly for the growth of pea-vines and clover, which thrive almost spontaneously upon them.

In addition to the soils above mentioned there is a large amount of bottom lands scattered along the numerous rivers, creeks, and branches that everywhere traverse this well-watered region. Though rarely of any great width, they are for the most part of great fertility and are highly valued. In some sections these lands have brought as high as $100 an acre, the adjacent ridge lands being thrown in at a nominal price, just as the pine barrens are in the sales of the low country rice lands.

PRODUCTIONS.—The skins and furs of wild animals were the earliest productions which the upper country gave to commerce. About the middle of the eighteenth century the "cow-pen keepers" and the "cow-drivers", led thither by the representations of the trappers, hunters, and Indian traders, built their cabins among these pastures and made large inclosures, into which their numerous herds were driven for marking, handling, etc. The business was a large one, and numbers of neat-cattle were driven annually to the markets of Charleston, Philadelphia, and New York. Horse-raising also was largely engaged in, and so highly were the qualities of the Carolina horse of that early day esteemed that a statute of the provincial legislature forbids the introduction of the inferior horses of Virginia and of other northern plantations. Around the "cow-pens" of the stock-drivers the first agricultural settlers appeared. Their crops of wheat and Indian corn formed for many years a considerable item of export from the province. Hemp was largely cultivated, particularly between the Broad and the Saluda rivers, and De Brahm says it was the finest and most durable grown anywhere in the world for the cordage of vessels. The culture of tobacco was engaged in, but was restricted by the difficulty of bringing so bulky an article to market in the then condition of the country roads. It was packed in casks, trunnions fastened to each head, shafts attached, and drawn as a large roller by a horse several days' journey to market. Silk was grown and the vine successfully cultivated by the early settlers of New Bordeaux, in Abbeville district. It is noteworthy that within the last few years, since the French vineyards have suffered from the phylloxera, hundreds of thousands of cuttings of the Warren grape, native here, besides the scuppernong roots, have been ordered by grape-growers in France, and being planted there they have yielded a wine of excellent quality.

The lands produce fine crops of hay, nearly three tons of clover per acre or the same of Bermuda grass having been cut in one season. Taking the value of the lands into consideration, it is claimed that forage can be obtained here more cheaply than in the famous blue grass region of Kentucky. The cost of German millet is placed at $6 per ton. Lucerne has long been established in this town, and there are stools of this valuable forage plant known to be fifty years old still in regions. In the same town one planter sowed in lucerne, in 1874, a half acre of red land, an old worn-out field infested with nut grass. In 1875 he got one cutting, and from that date to 1880 from 4 to 10 cuttings each year. The ten cuttings were obtained in 1878. The lucerne averaged 2½ feet in height at every

cutting, making a total growth for the season of 25 feet. By actual weighing each cutting averaged 4,189 pounds from this one-half acre, which was also carefully measured, giving a total of 20½ tons, or at the rate of 41 tons per acre. Since the invention of the cotton-gin the culture of cotton has so superseded all other agricultural pursuits that it might well be thought that nothing else could be grown here. Cotton planting has become so easy and simple, it requires so little individual thought and effort, the money returns are so certain and direct, or the crop may be so cheaply stored and preserved from injury for such an indefinite time, every business, trade, and industry accessory to the work of the farmer, from bankers and railroads to implement and fertilizer manufactures, have become so thoroughly systematized and organized in unison with this pursuit that any change is difficult, and, as a consequence, the other manifold resources of the country are neglected and undeveloped.

STATISTICS.—The metamorphic region embraces about 11,320 square miles, or over one-third of the entire state. The population numbers 395,043, the increase since the census of 1870 being 30 per cent. The density of population per square mile varies from 28 to 31 persons in Lancaster and Fairfield, and from 45 to 54 in Laurens and Greenville, the average being 31.4 per square mile, which makes it the most thickly peopled portion of the state, except the sea islands, which have 39.4 persons to the square mile. The percentage of colored population varies greatly in the different counties, being as high as 70 in Fairfield and as low as 34 in Spartanburgh; the average is 57 per cent. Of the 7,244,800 acres of land in this region 50 per cent. is in woodlands, 22 per cent. is in old fields, and 28 per cent. is tilled.

Farm-holdings.—There are 38,591 farms. This is an increase of at least 80 per cent. since 1870 and of 180 per cent. since 1860, while the increase in the decade preceding that, a time of much prosperity, did not much exceed 1 per cent. Fifty-six per cent. of the farms are worked by renters and 44 per cent. by owners. This is nearly 6 per cent. more of farms rented than in the state at large, or 10 per cent. more than in the other parts of the state. The maximum number of farms rented is 67 per cent. in Fairfield and the minimum is 42 per cent. in Laurens. Forty-five per cent. of the farms are under 50 acres, but 71 per cent. of the rented farms are under 50 acres, while only 13 per cent. of those worked by owners are under 50 acres. The farms under 50 acres worked by owners constitute only 6 per cent. of the total number of farms in this region; thus, notwithstanding the great subdivision of farm-holding that has been and still is taking place, it cannot be said that land is here in the hands of a small proprietary, as it is on some of the sea islands.

Tilled land.—The tilled land is 1,861,902 acres, an increase of 51 per cent. since 1870. This gives an average of 4.7 acres per capita, or nearly one acre above the average for the state and one-half more than in 1870. Of it 48 per cent. is in grain of all kinds, 40 per cent. is in cotton, and 12 per cent. is in other crops, gardens, orchards, fallows, etc. The proportion in cotton varies from a maximum of 50 per cent. in Laurens and Union to a minimum of 30 per cent. in Lancaster.

CROPS.—*Cotton.*—The production of cotton in 1879 was 274,318 bales against 93,494 in 1870, an increase of 193 per cent., or more than six times as great as that of the population within the same period. It constitutes 53 per cent. of the cotton crop of the state, or a little more than one-third of its area. The average number of bales per square mile is 24, and varies from 21 bales in Lancaster to 39 in Newberry county. In many of the townships the number of bales grown per square mile is much greater. In Fairfield county, township No. 3 produces 46 bales per square mile; in Newberry county, Floyd's township produces 47; in Chester county, Chester township produces 59; in York county, Fort Mill township produces 84. These facts indicate that the establishment of enlarged and improved gin houses for the better preparation of the staple is practicable in many places now, as they show that the main obstacle in the way of such establishment, the distance over which a sufficient quantity of seed-cotton would have to be hauled, is greatly lessening. The yield of lint cotton per acre varies from 200 pounds in Newberry to 152 pounds in Abbeville county, the average for the region being 166 pounds of lint per acre, which gives it rank as fifth in the state in point of production per acre. The yield of lint cotton per capita of population varies from 440 pounds in Fairfield to 216 pounds in Greenville; the average is 316 pounds, being less than in the red-hills region but more than it is elsewhere in the state.

Grain crop.—The grain crop is 7,731,528 bushels, an increase of 139 per cent. on the crop of 1870. The average yield for the whole region is 9 bushels per acre, and it varies from a maximum average of 13 bushels per acre in York to a minimum of 8 bushels in Laurens county, these variations depending more on the amount of attention bestowed on this class of crops than on differences in the productive capacity of the soil. The yield per capita of the population is 19 bushels, which is 4 bushels more than in 1870. If this were all corn or its equivalent, and were fed to the population at the rate of 10 bushels per capita yearly, and the work stock at the rate of 70 bushels a head, it would leave, counting nothing for the supply of other live stock, a deficiency of 1,091,000 bushels, or about 14 per cent. Estimated in the same manner, this deficiency was 31 per cent. in 1870. Compared with the other regions of the state, the yield per capita is below that of the sand hills, which is 32 bushels, and that of the Piedmont region, which is 20 bushels, but above that of each of the four others.

Work stock.—The work stock is one to every 27 acres of tilled land, the average for the whole state being 1 to 25. More land is tilled here to the head of work stock than elsewhere in the state, except in the red-hill region. As the lands themselves are not lighter or of easier tillage, this is chiefly due to a more economical use of this power.

The live stock number 473,180. This gives 42 to the square mile against an average for the state of 36. Although this region ranks third in its proportion of live stock to area, it was here that the first movements in favor of the

in a state of greater or less decomposition. Above the gneiss, whose outcrops are much confined to the beds of streams, islands of mica slate, occupying the more elevated lands, are found. The largest of these isolated bodies extends for a considerable width along the ridges above the Chattooga river. The proportion of mica slate is greater here than elsewhere in the state. Between it and the gneiss, and cropping out almost everywhere around the edges of the first-named rock, are extensive seams of hornblende rock, and its decomposition adds largely to the fertility, especially of the creek and river bottoms of this section. Above the mica slate, in the large body of rock on the Chattooga, some talc slate is found. This underlies a considerable area of itacolumitic sandstones, that in turn support several bodies of limestone rock. A number of lime kilns have been in operation here.

Of the useful ores and minerals of this section it may be stated that there are numerous gold deposits, at some of which washings have been carried on with much profit. Vein mining, in spite of many promising indications, has not been regularly undertaken.

Indian and revolutionary traditions tell of lead mines, which in former times furnished belligerents with an ample supply of this necessary metal. Unfortunately these traditions have not preserved the knowledge of their locality. At the Cheohee gold deposit mine on the headwaters of Little river, in Oconee county, Lieber examined a very promising vein of argentiferous galena which he thought might be profitably developed. Traces of copper were observed by Lieber on Tiger river, in Spartanburgh, near the galena mine above mentioned, and in some mill runs in southern Pickens and Greenville. Graphite is found on Paris mountain, and also in Oconee county. Manganese and iron occur, but have not been explored. Valuable soap-stone quarries have been worked to a limited extent in Pickens. Large sheets of transparent mica have been found near Walhalla, and asbestus of good quality is reported as occurring near Seneca city.

TIMBER GROWTH.—The prevailing growth is oak, chestnut, and short-leaf pine. Proceeding toward the mountains, the following trees mark the ascent in the order here named: Rock chestnut oak (*Quercus prinus monticola*), cucumber tree (*Magnolia acuminata*), mountain laurel (*Rhododendron maximum*), white pine (*Pinus strobus*), hemlock or spruce pine (*Abies Canadensis*). The forest products are shingles, tan-bark, and dogwood, with other hard woods, besides abundant timber for building purposes. The Indians once gained their chief livelihood here by gathering and disposing of medicinal herbs, such as pink root (*Spigelia Marylandica*), ginseng, and snake root, which are to be found in great abundance.

CLIMATE.—According to the physical charts of the Ninth United States Census and the rain charts of the Smithsonian Institute, second edition, 1877, this region has a mean annual temperature corresponding with that of Kansas or of New Jersey. The more mountainous portions have, however, a mean annual temperature that corresponds with that of Montana or the lower region of the great lakes. The mean of the hottest week of 1872, taken at 4^h 35^m p. m., was 90° F. The mean of the coldest week of 1872 and 1873, taken at 7^h 35^m a. m., was 25° F.

The prevailing winds are from the southeast, and the mean velocity of the movement of the atmosphere is much below the average for the United States at large. In the frequency with which this region is traversed by storm areas of about 50 miles in diameter, it ranks with the lowest in the United States. With the more extensive region south of it, it is peculiarly exempt from destructive storms.

Blessed with an unusual number of clear days and a large amount of sunshine the fig tree thrives here without protection at an elevation of 1,500 feet above the sea. "The climate is less subject to sudden changes than in the plain below. Vegetation is late, but when once fairly begun is seldom destroyed by subsequent frosts. Neither are there any marks of trees being struck by lightning, or blown up by storms."—(*David Ramsey, History South Carolina.*)

The annual fall of water is over 60 inches, which places this among the regions of heaviest precipitation in the United States. For spring it is over 18 inches, and for autumn it is 12 inches, which are also the maxima in the eastern United States. In winter the rainfall is 16 inches, which is less than the maximum, and in summer it is 14 inches, which places it third in a series of five, or just medium. Dewless nights rarely occur, and the luxuriant vegetation of this region does not in consequence suffer from the rigor of extreme droughts so frequent elsewhere.

The following observations on the temperature of springs in this region were made by Lieber:

Locality.	Time of observation.	TEMPERATURE.	
		Atmosphere.	Water.
		°	°
Poinsett's spring, in Greenville, near the North Carolina line.	June 7, 7½ a. m	72.05	56.86
Spring on Jones' Gap road, near turnpike gate.	June 16, 2 p. m	75.74	57.56
Cold spring on Cæsar's head.....	June 29, 9½ a. m	80.60	55.40
House spring, Cæsar's head.....	June 29, 10½ a. m	78.80	57.56

AGRICULTURAL FEATURES.—The soils are similar to those found elsewhere in the metamorphic region where gneiss rock prevails. On the more level uplands a gray sandy loam predominates; a red and sometimes yellowish soil with white clay on the mica slates, and a stiff red clay on the hillsides. In the bottoms a still darker and more

fertile loam is found. These bottom lands have long been highly esteemed as yielding abundant crops of corn, the small grains and the grasses. Little thought or attention was bestowed on the uplands previous to the attempts, so successfully made within the last few years, to introduce upon them the culture of cotton.

STATISTICS.—The Piedmont region of South Carolina embraces an area of 1,250 square miles, and is therefore the smallest division of the state here treated of. The population numbers 34,496, an increase of 66 per cent. since the census of 1870; this gives the density of population as 27 per square mile, which is below the average of the state and less than in other regions, the sand hills and the lower pine belt alone excepted. Twenty-six per cent. of the population is colored.

Eighty per cent. of the land is woodland and forest; 17 per cent. is tilled, and 3 per cent. is in old fields. The area of tilled land has more than doubled since 1870, being now 132,791 acres, and then only 64,802 acres. This is 3.8 acres per capita of population against 3.1 acres in 1870, showing that improvement has more than kept pace with the increase of the population.

The number of farms is 4,646, which gives an average of 28 acres of improved land to the farm. Of this number 43 per cent. are under 50 acres, and may be considered as in the hands of small farmers. Nevertheless there are some large landholders in this region. Of the farms, 45 per cent. are rented, and of these 74 per cent. are under 50 acres, showing that the renters are farmers on a small scale. Of the 55 per cent. worked by their owners only 15 per cent. are under 50 acres. Of *bona fide* small proprietors (if landholders of under 50 acres who till their own land may be termed such) the number is small, being only 7 per cent. of the total number of farm-holders. By far the larger number of farms are rented for a portion of the crop, very few being rented at a fixed money rental; for instance, in five adjacent townships in Greenville, where there are 631 farms rented, only one is reported as rented at a fixed money rental.

Of the tilled land, 88,766 acres, or 65 per cent., is in grain of all kinds; 25,740 acres, or 20 per cent., is in cotton; and 18,285 acres, or 15 per cent., in fallow and all other crops, including gardens, orchards, and vineyards, and a small area in tobacco.

The average yield of grain is only a little over 8 bushels to the acre, and does not express the capability of this section for the production of this article. Fields of corn on bottom lands averaging from 40 to 60 bushels are not uncommon, and the minimum calculation of the crop for uplands without manure is from 10 to 12 bushels per acre, while from 20 to 30 bushels are obtained by good culture. Rice has given here, without manure, over 100 bushels to the acre, though very little of it is planted. The yield of grain per capita is 20 bushels, and is greater than elsewhere in the state, except in the sand-hills regions.

The average product of cotton to the square mile is 6.3 bales, an increase of over 600 per cent. since 1870. This is more than upon the coast, in the lower pine belt, and in the sand-hills region, but much less than elsewhere in the state. The average yield of lint per acre planted in cotton is 141 pounds, which is 53 per cent. more than the yield on the coast, but less than elsewhere in the state. The product per capita is 105 pounds of lint against 14 pounds in 1870. This is 150 per cent. more than the product on the coast, and 54 per cent. more than in the extensive lower pine belt. Still, it is not one-half of product in the remainder of the state.

The work stock number 5,798 against 4,096 in 1870. This is 4.6 to the square mile, the average for the state being 5. The ratio of work stock to the population is less than elsewhere in the upper country, but more than in the regions below the red hills. There are 22 acres of tilled land to the head of work stock, which is more than elsewhere in the state, except in the red hills and the metamorphic region.

Other live stock numbers 66,035, being more per square mile than elsewhere in the state, and more per capita of the population, except only among the sand hills.

Analyses of soils and subsoils of South Carolina.

[Made for the Census Office.]

Number.	Name.	Locality.	County.	Vegetation.	Depth.	Insoluble matter.	Soluble silica.	Total insoluble matter and silica.	Potash.	Soda.	Lime.	Magnesia.	Brown oxide of manganese.	Peroxide of iron.	Alumina.	Phosphoric acid.	Sulphuric acid.	Water and organic matter.	Total.	Hygroscopic moisture.	Temperature of absorption, C.°	Analyst.
					Inches.																	
	COAST REGION.																					
6	Sandy soil	Northeast end of James island.	Charleston		12	89.368	2.062	91.430	0.131	0.077	0.038	0.154	0.077	0.598	2.845	0.206	0.154	4.789	100.499	4.120	25.0	J. B. Durrett.
	UPPER PINE BELT.																					
3	Sandy cultivated soil	Near Bennettsville	Marlborough	Originally long-leaf pine, undergrowth of oak and dogwood.	12	96.000	0.950	96.950	0.040	0.027	0.052	0.060	0.023	0.564	0.441	0.064	0.063	1.561	99.845	1.441	28.0	Chappell Cory.
7	Sandy mulatto cultivated soil.	Barnwell Court-House	Barnwell	Originally long-leaf pine and undergrowth of hickory and oak.	12	91.230	2.489	93.719	0.092	0.047	0.091	0.046	0.105	0.760	2.430	0.159	0.160	3.091	100.700	2.245	25.0	J. B. Durrett.
8	Sandy cultivated soil	Near Savannah river, from plantation of P. F. Hammond.	Aiken	Originally long-leaf pine, undergrowth of post and black-jack oaks.	12	93.695	1.483	95.178	0.076	0.060	0.114	0.202	0.020	0.737	1.840	0.036	0.106	1.771	100.146	2.512	14.5	G. E. Colby.
9	Sandy virgin soil	Red clay ridge, near Marlborough line.	Marion	Hickory, oak, and pine	12	84.754	4.435	89.189	0.192	0.069	0.068	0.294	0.086	1.997	4.854	0.022	0.236	3.312	100.269	4.518	14.5	Do.
	RED HILLS REGION.																					
1	Virgin red-land soil	3 miles below junction of Watereo and Congaree rivers.	Orangeburgh	Red oak, hickory, dogwood, and short-leaf pine.	12	88.960	3.055	92.015	0.115	0.050	0.062	0.028	0.096	1.250	3.979	0.096	0.047	2.621	100.361	1.982	26.6	J. B. Durrett.
2	Virgin red land, cultivated 100 years.	do	do			89.340	2.847	92.187	0.138	0.063	0.077	0.061	0.096	1.559	3.666	0.087	0.038	1.668	99.640	1.444	26.6	Do.
	METAMORPHIC REGION.																					
	Red clay lands.																					
10	Yellowish-red soil	Near Spartanburgh, N. C.	Spartanburgh	Post, white and black oaks, short-leaf pine and hickory.	5	77.860	1.790	79.650	0.092	0.041	0.036	0.070	0.056	5.646	7.538	0.082	0.058	6.167	99.436	4.685	21.8	C. Cory.
11	Red clay subsoil	do	do	do	5–20	43.740	5.870	49.610	0.214	0.067	0.003	0.212	0.010	11.700	26.536	0.134	0.009	11.660	100.175	11.210	21.8	Do.
	Clay, slate, or black-jack flatwoods lands.																					
4	Black-jack flat soil	Near Chester Court-House	Chester	Black-jack oak and short-leaf pine.	12	80.340	9.114	89.454	0.135	0.070	0.329	0.329	0.210	1.895	4.622	0.079	0.150	2.068	99.341	3.967	27.9	J. B. Durrett.
5	Cultivated soil	do	do			83.145	3.585	86.730	0.126	0.060	0.389	0.251	0.185	3.774	4.045	0.106	0.170	4.185	100.021	3.392	27.9	Do.

CULTURAL AND ECONOMIC DETAILS

OF

COTTON PRODUCTION.

REFERENCE LIST

OF

NAMES AND ADDRESSES OF CORRESPONDENTS.

COAST REGION.

CHARLESTON.—A. B. ROSE, Charleston, February 16, 1880; W. G. HINSON, James island, February 16, 1880; ELIAS S. RIVERS, James island, February 16, 1880; W. EDINGS FRIPP, John's island, June 30, 1880; J. JENKINS MIKELL, Edisto island, June 14, 1880.

LOWER PINE BELT.

HAMPTON.—HOMER H. PEEPLES, Peeples, June 28, 1880.
COLLETON.—JAMES W. GRAW, Walterboro', January 18, 1880; G. VARN, Folk's Store, August 18, 1880.
WILLIAMSBURGH.—JAMES M'CUTCHEN, Kingstree, March 26, 1880; W. H. B. TAYLOR, Black Mingo, June 22, 1880.
CLARENDON.—M. M. BENBOW, Wright's Bluff, March 12, 1880.
HORRY.—THOMAS W. BEATY, Conwayboro', July 20, 1880.

UPPER PINE BELT.

AIKEN.—P. F. HAMMOND, Beech Island, May 9, 1880.
BARNWELL.—JOHNSON HAGOOD, Columbia; JAMES C. BROWN, Millett, January 8, 1880; JOHN S. STONEY, Allendale; WILLIAM B. RICE, Bamberg.
RICHLAND.—THOMAS W. TAYLOR, Columbia.
ORANGEBURGH.—O. N. BOWMAN, Rowesville, June 5, 1880.
KERSHAW.—W. M. SHANNAN, Camden, June 21, 1880.
DARLINGTON.—J. J. LUCAS, Society Hill, March 13, 1880; ED. E. EVANS, Society Hill.
CHESTERFIELD.—HENRY P. DUVALL, Cheraw, June 24, 1880.
MARLBOROUGH.—C. S. MCCALL, Bennettsville, September 4, 1880; E. T. STACKHOUSE, Little Rock, April 13, 1880.
MARION.—W. D. JOHNSON, Marion Court-House, August 28, 1880.

RED-HILL REGION.

AIKEN.—T. W. WHATLEY, Aiken Court-House, July 17, 1880.
ORANGEBURGH.—J. E. KNOTTS, Knotts' Mills, March 1, 1880.

SAND-HILL REGION.

CHESTERFIELD.—S. G. GODFREY, Cheraw, January 2, 1880.

METAMORPHIC REGION.

LAURENS.—JOSEPH B. HUMBERT, Tumbling Shoals, June 14, 1880; G. W. SULLIVAN, Tumbling Shoals, December 25, 1879.
CHESTER.—JOHN C. FLENNIKEN, Chester Court-House, June 18, 1880; J. M. IVY, Rock Hill, July 2, 1880.
ABBEVILLE.—W. K. BRADLEY, Long Cane, August 16, 1880.
GREENVILLE.—W. L. DONALDSON, Greenville, January 15, 1880.
FAIRFIELD.—G. H. MCMASTER, Winnsboro', June 10, 1880; JAMES PAGAN, Winnsboro', March 9, 1880.
NEWBERRY.—MILTON A. CARLISLE, Newberry.
SPARTANBURGH.—S. C. MEANS, Spartanburgh, March 13, 1880.
YORK.—IREDELL JONES, Rock Hill, Febrnary 8, 1880.
LEXINGTON.—F. J. HARMAN, Lexington Court-House, July 27, 1880; J. A. SOMMER, Pemaria, April 6, 1880.

PIEDMONT REGION.

OCONEE.—A. R. BROYLES, Townville, May 1, 1880; L. B. JOHNSON, Walhalla, January 1, 1880.
PICKENS.—S. W. CLAYTON, Central, June 1, 1880.

Home-made manures are used so far as they go, with excellent results. Composts of muck and stable manure are coming more into use, and the field pea, either turned under green or allowed to wither on the surface, adds largely to the fertility; and by these means almost any of the uplands are made to produce a bale of cotton to the acre. The limited means at the disposal of the farmers in these respects, in a section where little attention is paid to corn and cattle, is largely supplemented by the purchase of commercial fertilizers, especially the Charleston phosphates. In Clarendon these are used almost exclusively, but in Colleton they are coming somewhat into disfavor, and the preference is given to the potash salts. Cottonseed, which was once thought to be only valuable as a manure for corn, is now applied with great benefit to cotton, and with the exception of a very small amount fed to stock, it is all employed in this manner; selling at from 10 to 15 cents a bushel.

UPPER PINE BELT.—Inclosures, under the colonial laws, that have not been changed, are required to be cattle-proof. The fences are built of pine rails 10 feet in length, running about 100 to the cord, worth usually 50 cents a cord, and are split for 50 cents per hundred, making the cost $1 per hundred in the woods. Fourteen rails make eight feet in length of worm fence, or 9,240 rails per mile, lasting on an average five years. A recent act of the legislature allows each township to determine by vote whether the crops or the stock shall be inclosed; if the latter, the township to tax itself for the fences necessary to protect it from the stock of the adjoining townships. To this date few townships in this belt have availed themselves of this law.

Drainage is little practiced in this region, the culture of the swamps being generally abandoned, and the uplands being thought not to require it. In Marlborough and Marion, however, great benefit results from a system of open ditches very generally adopted (see regional description). Little or nothing is required in the way of hillside ditches on these comparatively level lands, where little injury is experienced from washing.

The former practice of allowing fields to lie fallow, for the benefit of the growth of weeds, which increased the vegetable matter in the soil, and which killed by their shade the grasses that were especially troublesome on cultivated lands, has been almost wholly abandoned.

Nor is there any regular or general system of rotation of crops. Cotton lands especially are planted year after year in the same crop, and if properly manured are thought to improve. Rotation, when practiced, is two years in cotton and one year in corn; small grain is planted in the fall after the corn is gathered, and the next summer a crop of corn or cow-pease is grown on the stubble, to be followed the next spring by cotton. In Marlborough county lands planted in cotton for fourteen successive years, without additional manure except the cottonseed from the larger crops, produce double what they did at first.

The fall plowing of cotton and corn lands, once much practiced, has been very generally abandoned; some still think it pays to break the land 8 or 10 inches deep in the fall about every fourth year, otherwise it is only done to turn under weeds on land that has been resting.

The depth of tillage varies from 2½ to 6 inches measured on the land side of the furrow, and it is very rare to see more than one animal used in plowing. It is only the larger farmers (who are becoming scarcer) who use two-horse plows occasionally.

The amount of land once cultivated that has been abandoned is stated to be very little in Hampton county; from 10 to 20 per cent. in Barnwell; 10 to 15 per cent. in Orangeburgh; 25 per cent. in Darlington, and, excluding swamps, nothing in Marion and Marlborough. When the uplands are turned out in this region, they grow up first in broom-sedge, which is succeeded by short-leaf pine, beneath which, in time, all grass and undergrowth disappears. When again taken in, they yield well with manuring, but without good treatment they deteriorate more rapidly than virgin soil. (It is a question, on which there is a diversity of opinion, whether the second growth of pines is a benefit or an injury to land; in the lower country it is thought to be injurious, supporting the view that narrow-leaved growths do not improve the soil. In the upper country the opinion is, however, decided that the soil improves under the old field-pine. With some other growths there is no question in this regard; for instance, the persimmon always improves lands, and seems to exert no bad influence even on the growing crops in cultivated fields, it being often remarked that the tallest cotton is found under such trees, while it is dwarfed by the proximity of a pine or a post oak. Certain other forest trees seem to favor particular growths here, as the sugar-berry, under which verdant patches of blue grass are often seen when found nowhere else.)

Green manuring, especially with the cow-pea, is regarded favorably, although it is not practiced as a system. Sown broadcast, manured with the "ash element" (a cheap fertilizer composed chiefly of lime and potash) and turned under after the vines are wilted by frost, remarkable results have been attained. Colonel Thomas Taylor says that lands subject to rust, and never yielding more than 7 bushels of wheat, have given 26 bushels under this treatment. After the cotton is laid by, a furrow is sometimes run in the alley, and cow-pease are drilled in, forming the basis on which the next year's cotton bed is to be constructed. Pease grown among corn are esteemed highly for the beneficial influence they exert on the soil, as well as for the crop they yield.

The limited amount of stable and lot manure, furnished chiefly by the work stock, other cattle being rarely fed or penned systematically, is much valued.

Cottonseed is wholly used for manure, either alone or composted with woods-mold and litter, or the superphosphates, and its use has much increased. These means of maintaining the fertility of the land are largely supplemented by the use of guanos and other fertilizers. In Marlborough county the general rule is to return to the

land all the cottonseed produced on it, and in addition one sack of Guanappe guano, or half a sack of it, with 100 pounds of superphosphates, and if rust is apprehended 100 pounds of kainit. Lands so treated are counted on with much certainty to give a bale of cotton to the acre one year with another. This may be taken as the best established and most successful practice regarding manures. There are wide variations from it. A very few, but not the least successful farmers, purchase no commercial fertilizers, and rely wholly on cottonseed, composts of woods-mold and leaves, and stable manure. The use of fertilizers is very generally deprecated as unthrifty and extravagant, but the facility with which they may be obtained and used makes their employment the general practice.

RED-HILLS REGION.—Fencing to protect growing crops from the depredations of cattle running at large is now a heavy burden on the agriculture of this region. But public opinion is advancing so rapidly against the existing laws on this subject, especially in the upper country, that the present laws probably will be repealed. And while the right of pasturage in common on uninclosed and waste lands will be maintained, it will not be required to protect growing crops against cattle at large.

Drainage on these high lands is not practiced except occasionally where hillside ditches are required to protect very rapid slopes from washing.

Fallowing was formerly practiced in so far that a portion of each plantation "rested", that is, lay uncultivated every second or third year. Such practice now is the result rather of accident than of any settled economy of the farm, though it is still believed that land allowed to grow up in weeds or sowed in pease to be turned under is greatly benefited thereby.

The rotation of crops is also almost entirely neglected. Whenever and wherever a cotton crop can be planted, it is planted regardless of all system and rule. It is well known that a corn crop, followed by oats the same fall, with pease on the stubble the next summer, is excellent preparation for a cotton crop the season following; and also that, when these red lands are in good heart and well tilled, that is, when they are in condition to yield from 1,000 to 1,500 pounds of seed-cotton, they will with great certainty produce from 20 to 40 bushels of corn, 30 or 40 bushels of oats, as much as 100 bushels having been gathered more than once, and two tons of pea-vines, or without the pease, and will yield spontaneously in good seasons two cuttings, and in bad seasons one cutting of excellent crab-grass hay; all this, too, at a cost less than the culture of a crop of cotton necessitates and with advantage to the land. Nevertheless, these being crops mostly consumed at home and not considered as market crops, it is seldom a farmer is found willing to cultivate them and forego the yearly revenue in ready cash of his cotton crop.

METAMORPHIC REGION.—The usual depth of tillage is 4 inches on the land side of the furrow. In Abbeville, Spartanburgh, and portions of Chester, it is generally only 3 inches; in parts of Fairfield it is only 2 inches; but in some portions of Chester it is from 6 to 8 inches. The draft employed is almost always one horse, but in a very few instances two horses are used. Subsoiling has only been practiced on a small scale, chiefly as an experiment, generally with excellent results.

Fall plowing is very little practiced; it is opposed to what is known as the "David Dickson method of culture", which is the prevalent one, the opinion being that lands broken up in the fall become tightly packed by the winter rains; an evil not counterbalanced by the disintegrating influence of frosts in this mild climate. The additional expense is also a consideration. To the limited extent to which it is done five reports give the results as good, and in York and portions of Chester it is reported as greatly on the increase; five other reports state that it is of doubtful or of no advantage.

Rotation of crops is nowhere reduced to a system. With a moderate use of manures and careful culture the same lands are planted for years in cotton, as it is thought not only without deterioration but with actual improvement. The ratio which the price of cotton bears to that of meat and corn affects the succession of crops more than anything else. Nevertheless there is but one opinion as to the beneficial influence of a rotation of crops as a cheap means of preserving the thriftiness of the soil. The succession of crops, as elsewhere in the state, is cotton, corn, and small grain. The clean culture of cotton leaves the land in good order for any crop, and the small grain is planted in the same year after the corn is gathered. Usually the land is kept in cotton for from three to five years, and after one crop of corn and small grain is taken from it the culture of cotton is resumed.

Fallowing forms no part of the system of culture, and it is thought that the exposure of the soil by tillage to the summer sun is injurious. The fallows consist chiefly of the lands lying out after the small grain is gathered in May and June, and even then are generally used as pastures for stock.

The old fields are preferred in many instances to other wood lands, and they are being cleared of the short-leaf pine that covers them, and replanted. They produce well with fertilizers, and under careful treatment are thought equal to any of the land. One of the principal reasons for abandoning these lands, in the first instance, was the washes and gullies produced by the unskillful use of the plow. Efforts to remedy this by horizontal culture and hillside ditches where intelligently made, especially where the plumb or the level has been used to lay off the runs or the ditches, have been very successful. Unskillfully made ditches, however, often do more harm than good. Filling the gullies with brush is a safer and a very effective practice, but no attempts at underdrainage to remedy washing has been made. The damage is mainly to the hillsides, and it is seldom that the bottoms are injured by the detritus they receive.

Manuring has for its basis cottonseed. About 1,000 pounds of cottonseed is obtained from each bale of cotton, which makes 137,000 tons the supply of this region. Of this 25,000 tons, at 2 bushels per acre, is used for planting, and a small amount is fed to stock. None is carried to the oil-mills, and very little is sold, the price being from 10 to 15 cents a bushel, the balance, about 100,000 tons, being returned to the soil as manure. For small grain, it is sown broadcast and plowed in with the seed in the fall; for corn, it is killed by heating and applied in the hill; for cotton, it is becoming the practice to compost it with acid phosphate and stable manure, sometimes with the addition of other litter and lime. It is applied in the drill at the rate of a ton to from two to four acres. This leaves a large portion of tilled land to be supplied with manure from other sources. Corn rarely receives any manure, and the deficiency for the cotton lands, when the cotton-seed and stable manures are exhausted, is supplied by the purchase of commercial fertilizers. The amount purchased in this region reaches an aggregate cost of nearly $1,500,000, or $1 98 for each acre planted in cotton. It varies from a maximum of $3 33 per acre in cotton in Spartanburgh to a minimum of 92 cents in Abbeville. It is used most extensively in Spartanburgh, Greenville, York, and Anderson to stimulate the growth and maturity of the cotton-plant in these counties, which, being more elevated and nearer the mountains, have a shorter growing season. In Newberry, the county of the region most productive in cotton, the average is $1 02 per acre in cotton. Green manuring has been practiced only as an experiment. Such experiments with pea-vines have had a very promising success, but it has been found better to allow the vines to wither before turning them under.

PIEDMONT REGION.—One-horse plows are generally used, very rarely two horses. The depth of the furrow on the land side varies from 3 to 4 inches.

Subsoiling is not practiced. Occasionally lands lie fallow, and the result is beneficial if stock are not allowed to destroy the crop of grass and weeds. Cultivated fallows are unknown.

There is no system in the rotation of crops. After land has been planted two or three years in cotton it is planted one or two years in wheat, corn, or oats; the results of such a change are excellent if stock is kept off the stubble.

Fall plowing is little practiced; it has been found of advantage where stubble, grass, or weeds cover the land to turn them under at this time. The amount of land in old fields is not great. Such fields, after lying out eight or ten years, have been found to produce as well as ever, and most of them have been brought into cultivation again.

The washing of hillsides does not amount to a serious evil, and it is reported as easily prevented and effectually checked by hillside ditching where necessary.

The use of commercial fertilizers has largely increased with the facility of obtaining them by railroad, and the practical demonstration of their value is in the culture of cotton.

Cottonseed is worth from 10 to 15 cents a bushel; little of it is sold; it is applied green and broadcast as manure for wheat, and composted with stable manure and fertilizer for cotton. A portion is fed to stock.

PLANTING AND CULTIVATION OF COTTON.

COAST REGION.—A mule can do the plowing required in the cultivation of 30 acres in sea-island cotton, and can, in addition, cultivate a sufficiency of land to supply corn for its own feed, perhaps something over. The first step in the preparation of the land is to hoe off the weeds ("hurricane"), cut up the cotton-stalks, and pile and burn this litter. This costs 40 cents per acre. Bushes are grubbed up at a cost of 7 cents per acre. The land is not broken up broadcast with the plow, but early in February two furrows of a single-horse turning-plow are run in the old alleys, making a trench 7 or 8 inches deep. In this furrow a subsoil plow may or may not be run, according to the character of the subsoil. Wherever underdrainage is practiced, as on James island, this furrow is generally used. Before plows came into use this trench was never made, and even now it is omitted by some of the most successful planters. Into this trench, or into the middle of the alley where there is no trench, the manure is placed. This consists usually of about 20 cart-loads of marsh mud and from 1,000 to 1,400 pounds of cottonseed. Stable and lot manure, together with composts of marsh mud and rushes, are also applied in this furrow at the rate of 40 cart-loads per acre on such a portion of the land as the limited number of stock enables the farmer to treat in this method. On the lines of manure thus laid down a certain quantity of commercial fertilizer is drilled. This practice, wholly unknown formerly, is very common now, even the smallest negro farmers often going heavily in debt to obtain these fertilizers from the storekeepers. They are handy, obviate the labor and care of stock, and the forethought and toil of collecting and manipulating composts. On James' island and John's island a mixture consisting of 250 pounds acid phosphate, 200 pounds kainit (German potash salt) and 200 pounds calcined marl is applied per acre. On Edisto island they use 200 pounds fish scrap (half dry in barrels), 200 pounds kainit, and 200 pounds acid phosphate per acre. On Saint Helena island little fertilizer is used. Cottonseed is worth from $15 to $20 per ton, and the commercial fertilizers from $15 to $30, which would make $15 an acre the cost of manures among the best farmers.

The land is now ready for listing, which is done by hauling on to the manure with a hoe the soil from the tops and sides of the old bed. A more recent practice is to lap in with two furrows with a turning-plow on the manure. [illegible] 17½ cents per acre, while the listing with the hoe costs 80 cents, although the latter has the great [illegible]table mold and humus directly to the spot where the roots of the plants are to

Planting takes place about the 10th of April. The seedlings appear above ground in five to ten days, although when late planted, in a dry time, they may remain in the ground for four weeks, and when the rain comes still give a good stand. The work of chopping out the plants in a drill to a stand from 12 to 15 inches apart is commenced as soon as they are firmly set; that is, when they have a height of 5 inches and the third or first true leaf makes its appearance. It is desirable to complete the thinning early in June, in order that the plants may spread when the forms or squares are making their appearance.

The after-cultivation consists, usually, of four hoeings and four plowings, to keep the plant free from grass and the surface soil light and porous. These are completed from the last of July to the 1st of August.

The plant attains a height of from 10 to 15 inches before blooming, and the first blooms make their appearance from the 1st to the 20th of June. The first open bolls are seen from the last of July to the middle of August.

Picking commences from the middle of August to the 1st of September. By the 10th of November the cotton is generally all picked.

Black frost occurs sometimes as early as the 20th of October, but is not counted on until the middle of November, and it is sometimes deferred as late as the middle or end of December.

Cotton attains a height of from 2 to 4 feet, and is most productive at 3 feet. Fresh upland, unmanured, yields from 300 to 1,000 pounds of seed-cotton, the average being safely set at 600 pounds. Under good cultivation, even without manure, five crops may be taken without diminishing the yield; 1,425 pounds of seed-cotton is thought, on an average, to yield a bale of 475 pounds of lint, and the estimates of the amount required for this purpose range from 1,190 to 1,540 pounds. It is thought by some that the staple on old is shorter than that on fresh land, but so nice a point is difficult to decide, and there is no general opinion on the subject.

UPPER PINE BELT.—The first step in preparation for planting cotton is to dispose of the old stalks; if small they are not attended to; ordinarily they are knocked to pieces by hand with a club. Machines have been devised for this purpose, but have not proved successful, thus leaving a field open to inventors. When the stalks are very large, say from 4 to 5 feet high, they have to be pulled up, and sometimes to be burned. Some planters pull up the stalks and lay them in the furrow on which the bed is to be made; it is objected to this practice that the plow in cultivation strikes the buried stalks and destroys the young cotton.

The furrow of the bed is either run in the alley between the rows or the old bed is barred off and the furrow run through its center. The first practice alternates the cotton rows every year, the second plants on the same spot. The rows are rarely less than 3 feet 3 inches apart; they average 3½, and are sometimes 4 and even 5 feet on land making a large growth. The manure is placed in the furrow and the bed is built up in February and March, the object being to get cottonseed in and covered as early as possible to prevent its sprouting and heating after planting, which is injurious to the stand. In Marlborough the fertilizers are not applied with the cottonseed, but a furrow is run through the bed just before planting, and the fertilizer put into it then. The usual practice has been to put the manure in as deeply as possible; a practical difficulty in accomplishing this arises from the settling of the finely pulverized and lightly thrown up beds; the finer and specifically heavier particles of the soil pass through and under the coarser and lighter cottonseed, compost or stable manure. So that even after the greatest care has been taken to cover them deeply they disappoint the planter by appearing at or near the surface during planting or the subsequent cultivation of the crop. A very successful practice in Aiken and Barnwell counties has been to put the manure in a shallow furrow, but to finish the bed by splitting with a double-horse shovel-plow running to the depth of 14 inches. This leaves the sides of the beds and the alley light and loose, and it is kept so by after-cultivation. The sweep runs shallow in the harder soil near the plants, and deeper in the looser soil of the alley, and can thus skim the surface and destroy weeds near the plant without cutting the roots; the drainage of the bed is increased, and loose earth is provided, where it alone can be maintained during cultivation in the alley, to absorb atmospheric moisture, and to dirt the plant or the manure.

Planting occurs during the month of April, from the first to the 30th. Early planting runs the risk of frost, late planting the risk of a dry spell, which not unfrequently prevents cotton planted the last of April from coming up before the first of June.

Bancroft's or Dickson's improved cluster cottonseed is generally used; a prolific cotton, making a good yield of lint, being sought after, without regard to the quality of the staple. Improved staples have been produced, and are profitably cultivated by the larger planters who ship it themselves to the north or to Europe. Smaller farmers, confined to the home markets, cannot sell such staple to advantage, and therefore neglect it.

The quantity of seed used depends on the method of planting; in drilling by hand, the most common practice, 3 bushels are required; with the planter, which is coming more into use, 1 to 1½ bushels answers; with the dibble, a two-wheeled implement, drawn by a horse, the wheels running on the beds and making the holes for the seed by blocks fastened on the tires, a half-bushel will do.

The seed comes up, according to the greater or less favorableness of the season, in from four to ten days after planting. The young plants are thinned out to hills from 8 to 12 inches apart, sometimes to 18 inches; usually only one stalk is left, some prefer to have two. Thinning occurs from four to six weeks after planting, from the time that the third to the sixth leaf makes its appearance, and is completed early in June.

145 pounds. At that date, however, and for long afterward, probably not an acre of cotton was planted in the region now under consideration. The opening of the Air-Line railroad having reduced the cost of fertilizers, attention was drawn to the large bodies of gray sandy lands, hitherto little considered, and experiments in cotton growing by their aid proved so successful that the culture was largely increased. It has extended over the table-lands and even up the mountain slopes, and is now grown in every township of the region except one, Chattooga township in Oconee county, already referred to as the culminating point of the river system. It has been found that while the season is shorter the stimulation of the growth by the use of fertilizers compensates for this.

The same tillage as is given further south expended here, in a shorter period of time, has a like effect in pushing the plant to maturity. With slave labor this was inconvenient, if not impracticable. It has been further found that the growth of the plant is steadier here; it does not suffer from those checks during long dewless intervals which retard its progress in hotter and drier sections. The claim is also made that better cotton is grown here than further south. Experienced cotton buyers have long given the preference to staples of both long and short cottons grown toward the northern limits, respectively, of their culture. It is said that the fibers are stronger and of more equal and uniform length, admirable qualities, which might naturally be expected from a short, steady, and continuous growth. For all these reasons, together with the improvements in the selection of seed, by which the period of growth is lessened, and an earlier and more simultaneous ripening of the fruit is obtained, it is expected that what has been already done is only the commencement of a much wider extension toward the mountains of the growth of the cotton-plant.

No peculiarities of cotton culture are to be noted in this region. Little or no previous preparation is given the soil until it is thrown into ridges from 2½ to 4 feet apart, according to the strength of the land just before planting. The seed is planted from the 10th to the 20th of April, commencing on the same date as in the region below, but concluding earlier by from 10 to 20 days.

About two bushels of seed are used to the acre, and it is for the most part sown by hand, the outlay of $2 for a planter being generally considered too great for the advantage gained, especially by small renters, who hold their farms only for the crop season.

The seed comes up in from 6 to 15 days. The variety preferred is some of the cluster cottons, prolific bearers of early maturity.

In two weeks after planting the cotton is chopped out with a hoe to about 12 inches apart, sometimes to only 6 inches, and on very strong land intervals of 18 inches between the plants may be left. If the soil be well stirred with the plow and kept clean in the drill with the hoe the cotton will have attained a height of from 8 to 18 inches by the 1st to the 10th of July, when blooms will appear.

The first blooms are now looked for the latter part of June, but until the last year or two they were never expected before the 4th of July, and even that was thought early. Open bolls are seen from the 25th of August to the 1st of September.

Picking commences from the 10th to the 15th of September. The growing season ends with the first black frost, which occurs about the 15th of October or the 1st of November. The crop is gathered by the 15th to the 31st of December.

The plant is considered most productive when it attains a height of 2 feet. Fresh lands yield from 700 to 1,200 pounds of seed-cotton. The same lands after from two to ten years' culture without manure yield from 400 to 600 pounds of seed-cotton; with moderate manuring and fairly good culture they improve. It is estimated that it requires here an average of 1,455 pounds of seed-cotton to produce a bale of 475-pounds.

GINNING, BALING, AND SHIPPING.*

Ginning presents no peculiar features in the state. Sixteen different saw-gin patents are mentioned for the short-staple cotton, while for the sea-island long-staple variety the McCarthy roller-gin is used. Steam, water, and horse powers are used, and the amount of lint made in a day's run varies with the number of saws in the gin and the power employed.

The roller-gin, with steam-power, makes from 400 to 600 pounds of lint in a 10-hours' run; this lint is packed, by hand pressure, in round bags 7½ feet long, or, as the correspondent from John's island expresses it, "the press used is a hole in the floor, hung bag, iron pestle, and a negro." Three bags per day can be thus pressed. The weight given these bags of long staple is about 350 pounds; 1,600 of the seed-cotton is required for 400 of lint. They are not bound with ties as are the bales of short staple.

Upland cotton is put up in bales of from 425 to 550 pounds, as reported. Rather more than half the reports give 500 pounds as the weight of a bale. Iron ties are used exclusively.

The tendency of custom and of legislation is toward charging freight by weight, but reports vary greatly as to local practice. One line is reported as charging by measurement of space occupied; some lines are reported as charging by weight; some as charging by the bale, without regard to size; some as charging by the bale, but for all excess over certain weight, which weight is reported in different cases as 400, 450, and 500 pounds.

* The matter under this head has been compiled directly from the schedules.—E. W. H.

DISEASES, INSECT ENEMIES, ETC.

COAST REGION.—As has been already stated, the long-staple cotton is a more vigorous grower and less subject to disease than upland cotton. Neither sore-shin, blight, rust, or the shedding of fruit in unfavorable seasons seems to affect it to the same extent. Its enemies are in the vegetable kingdom, weeds and grass, especially the nut-grass and the Bermuda, and against these the constant and skillful use of the hoe and plow are the only safeguards. The most dreaded enemy of the crop is the cotton caterpillar, which makes its appearance in warm wet spells in the latter part of summer, and speedily consumes the foliage. At one time so great and constant were the depredations of these worms, that it was feared that they would, as they did for some years, put a stop to the profitable culture of this crop. Now, however, by the use of Paris green the planter counts securely on contending successfully with them, and no crop has been lost in late years where it has been used in season.

A mixture of 1 pound of Paris green, 1 pound of rosin, and 40 pounds of flour is dusted by hand over the eaves on the first appearance of the worm, and this inexpensive process secures exemption from their ravages even when they come in such numbers and work with such rapidity that the portion of a field not treated to the mixture, in consequence of the intervention of Sunday, is consumed beyond remedy.

LOWER PINE BELT.—It may be safely said that more injury is done to cotton in this section by grass than by anything else, and the only remedy that can be devised against this is hoeing and plowing. Crab-grass (*Digitaria sanguinalis*) is the chief intruder. In warm and wet seasons the cotton-plant sometimes grows too much to weed when heavily manured. Topping is tried as a remedy, but it is thought that underdrainage would be more effective.

"Sore shin" is supposed to result from bruising the plant by careless hoeing, and is not a trouble of much consequence here.

Shedding occurs in extremes of heat and cold. Rust and blight make their appearance late in July and August; they are attributed to the exhaustion of some elements of the soil, and potash is very popular as a remedy; they are likely to occur on coarse, sandy, ill-drained soil.

The caterpillar is seldom hurtful, and Paris green has been used successfully for its destruction.

UPPER PINE BELT.—There are few crops grown anywhere more certain of success than the cotton crop in the upper pine belt. A complete failure never occurs, and a reduction of 20 per cent. in the yield is an unusual occurrence. The greatest variations have been in an increase of product under better cultivation, and it is believed that a wide field for development lies in this direction. The principal obstruction to the growth of the plant is the crab-grass, necessitating constant labor and vigilance, or resulting in fatal injury to the crop. Usually the task is one acre in hoeing, which is completed by dinner time; but most frequently it is far from being thoroughly done. In Marlborough, where the work is well done, and perhaps on this account, two acres is the task, and it is usually completed by 4 p. m.

Drought is very seldom injurious except during the fruiting season in July and August. Sore-shin, except as resulting from bad hoeing, is not known.

Lice, a minute aphid, appears on the under side of the leaves in May and later, and gives them a curled, but at the same time a deeper green appearance. Dry weather is favorable to them, and in good seasons they are not thought to injure the plant. Some say they promote fruitfulness. In bad season, *i. e.*, excessive drought, during fruiting, rust appears earliest and is most injurious where they have been most numerous.

Rust and blight affect the crop especially during the fruiting season; it is most injurious to the prolific short-limbed cluster cotton. Under favorable conditions the plant will take on a heavy crop of fruit in from four to six weeks, any time from the middle of June to the middle of September. At such a period it will cease to grow, the leaves will pale and turn red, all the energies of the plant being devoted to reproductive efforts. Commercial fertilizers promote this crisis by contributing more to the fruitfulness than to the growth of the plant. Any vicissitude of the weather, heat or cold, wet or drought, will seriously enfeeble or even kill the plant in this, its term of labor, especially on poor, sandy, or ill-drained soils. A crop will have been made, the utmost that the soil, the variety of seed, and the seasons admit of, but the future growth and fruitfulness of the plant is checked or destroyed. This is what is equally termed rust or blight. The remedies are, varieties of the plant that are more vigorous growers, those of longer limb, and less given to excessive fruiting; stable manure in the place of fertilizers; the potash salts, which are used with marked benefit; and thorough drainage.

Cotton sheds by far the largest portion of the "forms" which come on it, and the closest observers state that in the great mass of our cotton lands the cotton-plant will not in the best of seasons mature into open bolls one in five of the blossoms that appear, generally not one in ten. Remedies for this are being sought in the selection of seed, and in various methods of culture, but nothing decided has been thus far obtained.

When the early season is wet and warm, the plant may run too much to weed. Some attribute this in part to late thinning and deep cultivation; others think it may be checked by running a deep, narrow furrow, closing after the plow, close to the cotton. Short-limbed varieties of cotton, and cottonseed, and phosphates as fertilizers are recommended as remedies.

Although the cotton caterpillar moth is frequently met with, even during the severest winters, the worm rarely makes its appearance before September, and hardly ever does any damage.

METAMORPHIC REGION.—In its early growth, unless in exceptionally windy and cold seasons, or through bad hoeing, cotton does not suffer here at all from "sore-shin". Nor does it often run to weed, though in unusually warm and wet seasons or on strong fresh land this may occur; cultivation and manuring are thought to check excessive growth and to promote fruiting.

Worms are rarely seen in this region and are not at all feared. Shedding and rust are often injurious. The first is likely to occur during alternations of dry and wet weather.

Black rust is confined to ill-drained soils, especially to those of the trap-rocks. Wet weather is more likely to affect the cotton-plant injuriously here than dry and hot weather.

No crop grown anywhere over so extensive an area is more certain than is the cotton crop in this region. Drainage and stable manure with fairly good culture are unfailing remedies for such diseases as have as yet affected it. The enemy most dreaded and most certain to require the best efforts of the farmer to hold it in check is grass, and with one consent the species is known as "crab-grass" (*Digitaria sanguinalis*), a corruption, John Drayton says, of crop-grass, as it was unknown until the land was cultivated. De Brahm, writing of Carolina in 1752, says:

> By cause new land produces scarse any grass, & once houing will do for the season, but the grass comes & increases in such a manner that sometimes three houings are scarse sufficient in one season; and when this comes to be the case the planters relinquish these fields for pastures & clear new ground of its wood.

This grass makes an excellent hay, attaining a height of from 2 to 5 feet, and yielding from 1 to 4 tons to the acre, according to the land and the season. Next to cotton picking, however, it is the chief source of trouble and expense in the culture of this crop.

PIEDMONT REGION.—Diseases and enemies are restricted here almost exclusively to one, viz, frost. Caterpillar is unknown. A little rust and shedding occur on ill-drained soils, but there is no general complaint regarding them. The vegetable enemy of the plant is crab-grass, with now and then complaints of rag-weed and may-pop vines.

LABOR AND SYSTEM OF FARMING.

COAST REGION.—On the sea islands of Carolina field labor is performed almost exclusively by negroes. Nearly all of them are engaged in farming on their own account; a large number own farms; a still larger number rent lands for cultivation, and even the laborers are paid most generally by granting them the use of a certain number of acres of land for certain stipulated services.

The total number of farms on the islands is stated to be 5,453, but the number probably exceeds 6,000, the enumerators having had the lands and crops cultivated by renters returned by the land-owners, and consolidating them as being under one management when they were, in reality, entirely independent—an error very likely to occur, and sometimes quite difficult to avoid.

The largest number of acres of sea-island cotton planted under one management nowhere exceeds 100 acres. The largest white planters do not probably average more than 30 acres, and this necessitates that he should be a landlord of considerable estate. For as the laborers are frequently given from 5 to 7 acres for two days' work in the week, and as this time does not suffice for the cultivation of more than 4 acres, to cultivate 30 acres of cotton under this system requires 75 acres of land; add to this the amount usually planted in corn and other crops, and we will have 120 acres. As under the best system the land lies fallow every other year, the planter of 30 acres of cotton will require 240 acres of open land; and as scarcely one-fifth of the land is under cultivation, such a planter will probably own some 1,200 acres. Thus there is no proportion between the size of the farm actually cultivated and the land holdings—the first being quite small and the last large. This state of things is owing to absence of capital and the low price of land and labor; lands which were worth from $50 to $60 an acre more than half a century ago (Mills' *Statistics of South Carolina*, pp. 372 and 472), and which increased in value down to 1860, being until quite recently either wholly unsalable or selling at $10 per acre or less.

On James island, which at this time is perhaps under a more progressive system of culture than the other sea islands, laborers are paid cash for their work at the rate of 50 cents per diem and $10 per month with board, the latter being a ration of 3 pounds of bacon and 1 peck of grits a week, with shelter and fuel. The soil and the condition of the laborers are reported as improving, and cash wages are considered preferable to the share or the land system of payment.

Arable land rents here at $2 an acre per annum. The price of land is from $15 to $30 an acre. A few laborers own their houses, but very few own any farming land.

On John's island cash wages are from $8 to $10 a month with board. Most of the laborers, however, are engaged for two days' work a week by allowing them a house, fuel, and 6 or 7 acres of land free of rent; but the report is that the system is not satisfactory. The land worked by the landlords is improving; that worked by the laborers on their own account is deteriorating rapidly. The labor is not so easily controlled as when cash wages are paid.

The lands vary greatly in price, prices ranging from $2 50 to $20 per acre, with some lands valued recently still higher. Rent is higher than on James island, in consequence of a system that increases the demand by multiplying small farmers, and it is about $3 per acre per annum.

On Edisto island the two-day system prevails. The laborer gives the landlord two days' work in every week ıring ten months of the year, and receives in return a house, fuel, and 6 acres of arable land, which, together with ıch other land as he may rent, he cultivates on his own account during the remainder of the week. When extra work required on the farm, these laboring tenants are employed at 50 cents per day. The system is reported as being ıite unsatisfactory, these two-day hands not cultivating more than two acres as an average for the proprietor, and ırdening his estate with the support of a much larger population than necessary to its cultivation. By means of is, however, a large amount of resident labor is secured on the place, which is of prime importance during the tton-picking season. The laborers themselves prefer this system, having four days out of the week for themselves; ey are more independent, and can make any day they choose a holiday. As a rule, they are in comfortable rcumstances, and about 7 per cent. are reported as owning homes of their own and some land.

The land for which they pay rent service generally deteriorates in value. The lands worked by the proprietors e among the very best on the sea-coast, and are improving.

The average yield of cotton on the whole island is a bale to 2.6 acres; for the six largest planters it is a bale to 7 acres. Considering the quality of the staple produced, it may be safely said that the larger farms yield between vo and three times as much as the small ones.

Lands here are worth from $10 to $25 per acre; formerly they were worth from $50 to $70 per acre. Small acts rent for about $4 per acre per annum, larger tracts for less; and there is a state of things which tends to educe the salable value of lands while it increases the rental value of it.

West of Saint Helena sound land is almost without exception in the hands of small negro farmers, either as enants or proprietors. Much of this land, valued formerly at from $40 to $60 an acre, was confiscated as a war ıeasure by the United States government. A good deal of it was purchased by negroes at the government sales t $1 25 an acre, on credit, and is still owned by them. These small negro farmers have enjoyed many advantages. hey bought their lands on easy terms, at from one-thirtieth to one-fiftieth of their value, and had the benefit of the ımine prices of cotton during the war for their staple product.

The size of the landholdings is from 1 to 20 acres, and nowhere are more than 15 acres of cotton cultivated nder one management. Much of the land is uncultivated, and the remainder is planted in small patches, varying om ⅛ of an acre and less to 3 acres in size, consisting of corn, cotton, and sweet potatoes, curiously intermingled.

Nowhere in the state, not even among the gardens on Charleston Neck, is the system of small culture so trikingly illustrated. The farmers usually own a cow, a mule, or a horse, and the work stock is sufficiently numerous, though of a very inferior quality. Farm fixtures are of the simplest and cheapest description. There ı seldom any shelter for the stock, the cabin of the proprietor being generally the only house on the premises. he stock is fed on marsh-grass, with a little corn, and is in a large measure subsisted by being picketed out, when ot at work, to graze on such weeds as the fallow spontaneously furnishes.

Plows are numerous enough, but the chief reliance is upon the hoe, which for several generations was the nly implement known to agriculturalists on this coast.

Since the war the industries connected with the working of the phosphate rock in the rivers and on the mainland djacent to them have furnished the men with employment at higher wages than could be obtained elsewhere in the tate. The opening of the railway to Port Royal harbor has also made a demand for labor in loading and unloading essels at a better per diem than was elsewhere obtainable.

Graded schools were early established here, and have been maintained on a large scale uninterruptedly for ıany years. Fish, oysters, and game abound; and poultry, as chickens, ducks and turkeys, does particularly well.

The laborers live comfortably, happily, and peacefully. All the larger houses and buildings about the old ırmsteads have rotted down or have been burned down, and have been replaced by small cabins, and a few country tores, where the traders, invariably white men, who take no part in the cultivation of the soil, collect and dispose f the crop and supply the community with such articles of food and dress as are required. Most of the men are ngaged at the phosphate works or on the wharves at Port Royal, and the bulk of the farm work is performed by he women and children. Land is worth from $10 to $15 an acre.

Purchasing supplies on a credit prevails to a considerable extent, especially among the small farmers. The xact rate at which these advances are made cannot be given, as it is not charged as interest, but is included in an ıcreased price asked for supplies purchased on a credit. It varies from 20 to 100 per cent. above the market value f the goods, according to the amount of competition among the storekeepers, who here, as elsewhere in the state, re by far the most prosperous class of the community, in proportion to the skill and capital employed. The better lass of farmers do not approve of this credit system. It furnishes facilities to small farmers, encouraging them to ndertake operations they cannot make remunerative to themselves; it reduces the number of laborers, and recludes high culture. The rental value of land is thus increased, and land which could not be sold for $10 may e rented for $5.

The thriftless culture resulting from the small farms, unduly multiplied by this unhealthy stimulus of credit, auses many acres to be thrown yearly out of cultivation. Thus the increasing demand to rent land, in consequence f the increasing facilities for credit to small farmers and the constantly diminishing area of arable land resulting

from the very imperfect system of culture their lack of means forces them to adopt, create high rents injurious to the small farmer, and impoverishes the landlord by deteriorating the quality of his land, as well as by abstracting the labor he would employ in remunerative culture.

LOWER PINE BELT.—In Colleton county the farms on which cotton is planted vary in size from 50 to 200 acres, and are, in some instances, as much as 400 acres. A system of mixed farming is pursued; food supplies mostly, and in an increasing degree, are raised at home. Bacon for the laborers, however, is usually bought in Charleston. There are a few white laborers, but the labor is chiefly performed by negroes. Wages vary from $6 a month to $120 and $150 a year. Very few farms are worked on shares; when it is done, the landholder usually furnishes all supplies, and takes one-third of the cotton and one-half the provision crop. The share system is not entirely satisfactory. The quality of the staple is not affected by it, but the quantity produced is small, and the land deteriorates. Money wages are preferred, because it places the management under intelligent control, enables the laborer to meet his current expenses, and preserves his independence from debt. The condition of the laborers is good, and about 2 per cent. of the negro laborers own some land or the houses in which they live. The market value of land is from $2 to $5. The rent is from $1 50 to $3 an acre. The system of receiving advances on the growing cotton crop is diminishing.

In Williamsburgh county the farms on which cotton is planted vary from 100 to 600 acres in size. Mixed farming is practiced; the family supplies of the landlord being usually raised at home, those of the laborer purchased in Charleston; the tendency to raise supplies is increasing. There are some white laborers, but generally negroes are employed; wages, averaging $8 a month, are paid monthly or oftener. A few cotton farms are worked on shares—the terms being a net one-quarter of all the crops for the landlord, he for the most part advancing all supplies. Land deteriorates under the share and improves under the wage system, which latter is better for the laborer, his energies being more intelligently directed his labor is more productive and worth more, besides it induces economy, enables him to understand fully his financial condition, and he is more satisfied at the end of the year than when there is a settlement of accounts, the run of which he cannot keep. There is little demand for land; the price ranges from $2 to $15 per acre. It rents for from $1 to $2 an acre; more generally for one-quarter or one-third of the crop. The system of credits and advances on the growing cotton crop prevails largely, from one-half to three-quarters of the farmers, black and white, receiving such assistance.

In Clarendon county the usual size of a cotton farm is 80 acres. Mixed farming is practiced, but much of the supplies consumed is purchased in Charleston, though the tendency to raise them at home is increasing. The field labor is performed by native whites and negroes. Laborers are usually contracted with by the year, and the settlement takes place at its close. One-third net of the crop to the landlord is the usual rate, where cotton farms are worked on shares, he advancing all supplies. The share system is preferred to wages. The condition of the laborers is good, and about 5 per cent. of them own houses and lands. Land is worth from $3 to $5 an acre, and rents for $1 per acre. The liens for advances on the growing crops recorded in the clerk of court's office for the year number 2,716, or one to every farm save nine, and aggregate $283,317 18.

In Horry county the farms average 50 acres and run from 10 acres to 200 acres in size. All supplies are made at home. The laborers are largely white natives, but there are some negroes. Wages, from $5 to $16 by the month—from $50 to $125 by the year. No cotton farms are worked on shares. The soil improves under culture. The wage system is preferred. The condition of the laborers is good, and about 12 per cent. of the negroes own houses and land. Unimproved land sells for from $1 to $2 an acre; very few advances on the crop, and those wholly for fertilizers. The liens on the growing crop recorded in the clerk's office number 27, and aggregate $1,179 80.

UPPER PINE BELT.—A mixed system of farming is pursued in the upper pine belt, and the attempt is made to raise at least a portion of the necessary supplies. They are not raised, however, to the extent they were formerly, and although the reports all state that the tendency to raise them is now increasing, the deficiency still remains very great, as the number of liens given for provisions and recorded against the growing crop show.

In Barnwell there were 2,026 liens, averaging $125, being $8 80 per bale of cotton produced; in Orangeburgh there were 2,470, liens, averaging $90, being $9 87 per bale; in Darlington there were 3,925 liens, averaging $100, being $16 40 per bale; in Marlborough there were 1,183 liens, averaging $110, being $5 40 per bale; in Marion there were 1,200 liens, averaging $100, being $5 50 per bale. The number of liens for 1880 show an increase on those given above for 1879. This does not indicate a diminution in the amount of supplies raised by farmers, but only shows an increase in the number of laborers who are seeking a credit, to enable them to do business on their own account as tenant farmers. It is by this class chiefly that the liens are given, mostly for provisions, next for fertilizers, and to some extent for mules and farm implements. It is the general experience that these small tenant farmers, mostly negroes, meet their obligations to the best of their ability; nevertheless, a mortgage given in January or February on a crop not to be planted until April, is not taken as a first-class commercial security, and consequently the charges on the advances are heavy; for instance, when the cash price of corn is 75 cents, the credit price is not unfrequently $1 25 and upward.

West of the Santee and Wateree rivers, in this region, the average acreage in cotton to the farm is 14 acres; on only one farm is there over 400 acres in cotton; in 17 townships the maximum acreage is under 100 acres; in 20 townships it is from 100 to 200; in 5 townships it is from 200 to 300; in 2 townships it is from 300 to 400.

East of the rivers named there are farms having over 600 acres in cotton, the average acreage in cotton to the farm is 16 acres. Here 46 per cent. of the farms are rented, and 54 per cent. worked by the owners. Of the rented farms, 13 per cent. contain over 50 acres, while of those worked by the owners the area of only 20 per cent. are below that figure.

The laborers are chiefly negroes, but the number of whites engaged in field labor is largely increasing in some localities, especially east of the Pedee, where from one-third to one-half the field labor is performed by whites. The general price of day labor is 50 cents (and food), though it fluctuates from 40 cents to 75 cents. This class of laborers is also largely increasing, being recruited from the increasing class of tenant farmers, who supplement their earnings by hiring out when not busy with their own crops, or when pressed for ready cash. Contract laborers are becoming much fewer; the general wages is $10 a month and rations, but in some localities it is as low as from $6 to $8, and in others as high as from $12 to $15, the higher prices prevailing in the northeast, the lower to the southwest, being less where the percentage of negroes is greatest, and *vice versa*. Hands hired by the year receive from $90 to $120, with rations, shelter, firewood, and truck patches; but they have always preferred, when contracting for a year's work, to have some interest in the crop, and this desire has steadily increased so as to have made this by far the most general practice. This has been arranged in so many and in such complicated ways as to preclude any general description.

For instance, a widely adopted system is one proposed as early as 1866 by a negro laborer in Silverton township. The laborer works 5 days in the week for the land owner, and has a house, rations, and three acres of land, with a mule and plow every other Saturday to work it when necessary, and $16 in money at the end of the year. Had he worked 4½ days per week for the land owner and 1½ for himself, this would have been equivalent to one-fourth of the crop and his food. The $16 was intended to cover the 52 half days more than that in which he worked for his employer, amounting in all to one month. This system proved very successful, and the second year a number of laborers proposed to work only 4 days, feed themselves, and take double the land and mule work, without the money. The third year three-day hands came in, furnishing in part their own work stock; and as some hands paid the rent for a house and an acre of land by giving 2 days work a week, there were found various classes of hands on the same places working from 2 to 6 days in the week.

The share system is practiced more largely in Barnwell than in Hampton, and still more in Darlington and Marlborough. The terms are generally the same, the employer furnishing land, teams, and implements, the laborer feeding himself and getting from one-third to one-half of the crop, after paying his *pro rata* for bagging, ties, and fertilizers. Chancellor Johnson (Marlborough county) says:

> I have a good many tenants, white and black. I furnish the stock, food for it, pay one-half the blacksmith, fertilizer, bagging, and ties accounts, and furnish ginning facilities. The tenant (has his garden and potato patch free) does all the work, from repairing fences and ditches to preparing the crop for market. My advances are repaid, and the crop is equally divided. The tenants generally get at the rate of from 8 to 10 bales for each mule they work, grain for their family supplies and to make their meat. I get the same amount of cotton and more than grain enough for the next year's crop. I have had some tenants for over ten years.

He prefers hired labor where the plantation is not too large—that is, about eight plows. The advantage of either system depends upon the character of the individual, good tenants being sometimes poor laborers, and *vice versa*. Each locality reports favorably of the system pursued there.

In Hampton the wage system is preferred, the laborers run no risks, the soil is improving, condition of the laborers good, very few of them own house or land. Lands sell for from $1 to $25 per acre, and rent for from $1 to $3 in small patches; little land is rented.

In Barnwell the laborer decides under which system he will work. Share hands and renters pick cotton cleaner than wage hands. The wage system is preferred by the planters; the laborer runs no risks, his pay is net money, he spends it and lives and works better, and the land improves. The condition of the laborer is good and improving; quite a number own houses and lands. The market value of land is from $3 to $10 an acre, including improved and unimproved. The rent is from $1 to $3 in money, or in produce it is 75 pounds of lint cotton per acre, or 1,000 pounds of lint for a 40-acre farm, or a 500-pound bale for from 15 to 20 acres.

In the lower part of Orangeburgh year hands receive monthly $6; the share system is also practiced there; no preference expressed between the two. The condition of the laborers is reported as good. The market value of land is from $2 to $10, and a good deal is rented from $2 to $4 per acre.

In Darlington wages by the year are $120 for men, $90 for women, with house, rations, fuel, and truck patches. The share system and tenant system are largely practiced; the laborers do not work so well, nor do they realize so much, but they prefer less with independence of control; their condition is good, and 2 per cent. own houses and land. The market value of land is $10 per acre, and the rental yields about 7 per cent. on the investment.

In Marlborough and Marion a considerable part of the field labor is performed by whites; day wages are from 30 to 60 cents, by the month from $6 to $12, and the same when engaged for the year; in all cases with board.

The share and tenant systems are largely practiced. (See above for terms, etc.) The condition of the laborers is good, they are contented and happy, and from 3 to 5 per cent. of the negroes own land or a house. The market value of land is from $10 to $50 per acre, and rents are from $3 to $15 per acre.

From the southwest of Aiken county it is reported that the tendency to raise supplies fluctuates with the price of cotton, being increased by low, and diminished by high prices. The share system is largely practiced, the laborer having one-third when he feeds himself, one-fourth when he is fed; the land owner advances everything, and the laborer's proportion of the expenses is taken out of the crop. The share system is not generally satisfactory; it is difficult to get cotton cleanly handled; land worked under the supervision of the proprietor generally improves; when rented, especially to negro tenants, it rapidly deteriorates; 5 per cent. of the negro laborers own land or their house; those who work steadily are prosperous, the proportion that do this is not, however, large. The market value of land is from $4 to $15 per acre, including woodland; tilled land rents for from $1 to $5 per acre.

The following comparison, in some of the regards above treated of, between Darlington and Marlborough counties is offered, because in 1870 Darlington led all the counties in the state in the production of cotton, nearly doubling the crop of the county next in rank; now it stands eighth in total production, and Marlborough stands highest in the yield per capita and per acre; the counties lie side by side:

Comparative statement.

	Darlington county.	Marlborough county.
Yield in lint cotton:		
Pounds per capita	330	548
Pounds per acre	190	267
Amount of liens for each bale of cotton produced in 1879	$16 40	$5 40
Percentage of farms:		
Worked by owners	43	55
Worked by renters	57	45
Under 50 acres, worked by owners	17	12
Over 50 acres, worked by owners	83	88
Under 50 acres, worked by renters	85	80
Over 50 acres, worked by renters	15	20

RED-HILLS REGION.—Although a system of "mixed farming" is claimed as the usual practice here, about one-fourth of the corn, one-third of the bacon, and one-half of the flour consumed on the farm is, under the most favorable circumstances, purchased; ordinarily a much larger proportion is bought. These supplies are for the most part brought from the northwest by railroads, and are chiefly sold to the farmers, especially the smaller farmers, who are mostly renters, on credit, the larger holdings being more generally worked by their owners. The payment for these advances is secured by what is known as a lien.

The lien is a bond for the payment of a specified amount—usually about $100—given to the storekeeper by the farmer, and pledging the growing crop as collateral security. On this acknowledgment of indebtedness—which by act of the legislature covers the entire crop of the party giving it—the farmer receives from time to time during the crop season such supplies as may be agreed on between him and the storekeeper. These liens, bonds, or mortgages on the growing crop are recorded in the office of the clerk of the court, the names of the parties with the amount of the debt and the date of the transaction alone being entered in a single line, in a book kept for the purpose, at the cheap rate of 10 cents an entry. This record gives these debts precedence of other indebtedness. The collection of these liens is equally simple, cheap, and prompt. On affidavit of the lien holder that he believes his debtor means to avoid payment, the clerk of the court orders the sheriff to seize the crop, and sell the whole, or so much of it as will pay the debt with costs, and to devote the proceeds to those purposes; while the lien nominally covers the entire crop, the parties making advances depend almost exclusively on the cotton crop, because of its easy convertibility into money. This greatly encourages the culture of cotton among the necessitous small farmers. This class of farmers have been steadily on the increase, and the farms which compare in size with those of former days are so few that they might be readily enumerated. In this entire region only 8 can be counted, where the acreage in cotton under one management exceeds 100 acres. It must be mentioned, however, that in the neighborhood of large farms, the product per acre, the rate of wages, and the value of lands are greater than where there are only small farms. Thus near Wedgefield, in Sumter county, Mr. Aycock purchased a large body of these red lands a few years since, at from $4 to $6 an acre, and commenced planting on a large scale. Three years afterward similar lands in the Wedgefield neighborhood were selling at $25 an acre, while the very same character of land in adjacent townships, and indeed in most localities in this region, may be bought still at from $3 to $6 an acre.

Notwithstanding the great healthfulness of this region, the larger portion of the field work is performed by negroes. In some localities, however, as at Wedgefield, white immigration has commenced. Where the custom is to pay money wages, the rate for a full hand is $120 for the year, with shelter, fuel, and food; for the month, from

the health of the slaves has bequeathed regulations regarding labor not customary elsewhere. Work commences at sunrise and is over with at sunset, no night work of any kind being required; the time allowed for meals varies, for dinner it is from one to three hours, according to the length of the days. All exposure to rain or bad weather, even in pressing exigencies, is scrupulously avoided, and during exceptionally chilly weather little work is obtained or expected from negro laborers.

A large proportion of the land is worked on shares. When the landlord furnishes the tools, stock, and stock-feed, he takes one-half the crop in Laurens, Chester, Abbeville, and York, and in portions of Fairfield and Spartanburgh counties. In Greenville and in portions of the counties last named the laborer takes one-third and the landlord two-thirds under the above conditions. In Greenville, also, the laborer takes two-thirds if he furnishes tools, stock and feed for it. The portion paid for land alone varies from one-third to one-fourth of the crop, the latter rate being the most general one. In Laurens, Newberry, and Spartanburgh, and in portions of Fairfield and Chester, wages are preferred, the laborer running no risks of the seasons, faring better, and working better in consequence. In Abbeville and York the share system is preferred and is the prevailing practice, the demands on the care and attention of the landlord is less, and the independence of control and freedom from steady work it affords the laborer is highly prized by him: In Greenville laborers owning stock, tools, and provisions find the share system most profitable, otherwise they prefer wages.

Tolerable satisfaction with the system prevailing in each locality is expressed, but the feeling is general that the relations of labor and capital are in a transition stage, and either that those now existing need perfecting, or that better ones would be preferred. Eight out of nine correspondents report that under the present system the lands are not improving, but deteriorating, especially those rented and worked on shares; the ninth only qualifies the general verdict by the expression that with care it improves. Though there may be much sad reality in these statements, they are considered in connection with the facts above given, which show that within the last decade the two leading crops in this region have increased, one by 172, and the other by 139 per cent.

Statements regarding the average market value of land vary with every locality; they are for Greenville and Laurens from $6 to $10 an acre, for York $6, for Abbeville and Spartanburgh $10, for Newberry from $6 to $25, for Fairfield from $3 to $15, and for Chester from $7 to $18. There is little land for sale, but nearly all of it is for rent. Only 3 out of 11 correspondents state the rental of land in money; it is put in York and Chester at $2, and in Laurens at from $3 to $4. Three state that no land is rented for money; in these cases one-fourth to one-third of the crop—estimated in Fairfield at an average of $5 an acre—is given, or a larger proportion where stock and other supplies are furnished. In Abbeville the average rent is given as 3 bales of cotton for so much land as one plow can cultivate; in Fairfield it is 900 pounds, and in Chester as much as 1,200 pounds of lint; or, in other words, something over 1,000 pounds of lint cotton, worth $100, for the rent of 30 acres of land. This would be $3 33 rental per acre, which is the interest at 7 per cent. on capital of $47 50; taking 7 per cent. as the standard rate of interest, this may be taken as the intrinsic value at present of the arable lands of this region. As, however, only 28 per cent. of the lands are under the plow, this amounts only to an average minimum valuation of $13 30 per acre for all the land tilled and untilled.

As stated in the returns of the Tenth United States Census, which may be considered as fairly up to the actual average market values, the lands with all farm improvements are put at an average of $4 87 an acre. At this valuation, placed upon them by their owners, these lands are paying dividends not less than 23 per cent. per annum, not taking into account that more than two-thirds of these values are wholly unemployed, and that the remaining one-third is operated mainly by the poorest and most ignorant class of the community, where want of means alone would prevent them from obtaining such returns as good culture would give.

PIEDMONT REGION.—The farms are very rarely larger than can be worked by four horses. The landholdings average from 150 to 300 acres, including wood lands. The larger portion of the farm supplies are raised at home, but near the towns and along the Air-Line railroad supplies from the west are largely purchased; the system of credits and advances to the smaller farmers prevails, absorbing, with rents, not unfrequently seven-eighths of the entire crop. Most of the land is rented or worked on shares. The cash rental varies from $2 50 to $4 an acre; the usual terms are one-fourth the cotton, and one-third of the grain; where stock and implements are furnished by the landlord he gets one-half the crop. The average market value of the lands is stated at $5 an acre; improved lands sell at from $6 to $10 per acre. About one-half the field laborers are negroes, and since the extension given to cotton culture they are on the increase. Wages are 50 cents a day; from $6 to $8 a month with board; $75 a year with board. The condition of industrious laborers is good. The number of negro laborers owning houses or land varies from 1 to 5 per cent., according to the locality.

COST OF COTTON PRODUCTION.—The estimated cost of production of the sea-island variety is from 15 to 20 cents per pound; that of the upland or short staple is from 7 to 9 cents, though a few correspondents place the estimate at 5 or 6 cents, and others at 10 cents.

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LETTERS OF TRANSMITTAL.

BERKELEY, CALIFORNIA, *May* 31, 1883.

To the SUPERINTENDENT OF CENSUS.

DEAR SIR: I have the honor to transmit herewith a report on the cotton production and agricultural features of the state of North Carolina, by Professor W. C. Kerr, special agent in charge of the subject for the state.

Professor Kerr's long-continued connection with the geological and agricultural survey, as well as with the agricultural experiment station and board of agriculture of his state, imparts to his presentation of its natural features and most important agricultural industry an unusually authoritative character, from a thoroughness of personal knowledge that also finds expression in the brevity and terseness of his descriptions. While a portion of the matter has already been given to the public in state publications, yet in its present complete and unified form this report will convey so many more definite and connected impressions of the natural and industrial characteristics of North Carolina as to render it of great interest both to the general reader, the student, and to those directly interested in industrial pursuits.

Very respectfully,

EUG. W. HILGARD,
Special Agent in charge of Cotton Production.

Professor EUGENE W. HILGARD,
Special Agent in charge of Cotton Production.

DEAR SIR: I have the honor to transmit herewith my report on the cotton production of North Carolina. You will observe that I have followed closely the model of your Louisiana report, giving:

(1) Tables of acreage and production of leading crops.

(2) A description of the physical geography.

(3) A description of the agricultural regions.

(4) General discussion of cotton production and culture.

(5) Description of the counties in the several agricultural regions.

(6) Abstracts of the schedules of cotton production appended to each description.

(7) Abstracts of schedule answers to questions regarding cultivation, markets, diseases, etc.

The sources of information for this paper are—

(1) For the topography and geology, personal notes of observations throughout the state.

(2) For climate, tri-daily observations made under the direction of the state geological survey at about thirty stations during the last twelve years, and publications of the Smithsonian Institution and of the signal service.

(3) For soils, forests, and other agricultural data: first, personal notes of observations in prosecution of the geological survey in every county of the state, Ruffin's *Sketches of Eastern North Carolina*, and Emmons' *Swamp Lands;* second, maps of the state land surveys, chiefly of the public swamp lands; third, unpublished maps of numerous railroad surveys; and fourth, the answered schedules of questions, from which some details have been obtained for parts of a few counties.

The analyses of soils given in the text were made in part for the Census Office by Messrs. J. B. Durrett, C. Cory, H. McCalley, and R. H. Loughridge at the University of Alabama, and in part for the state geological survey by Messrs. C. H. Bogardus, of the New Jersey survey, and G. B. Hanna, assayer of the United States mint at Charleston.

Very respectfully, yours,

W. C. KERR.

TABULATED RESULTS OF THE ENUMERATION.

TABLE I.—AREA, POPULATION, TILLED LAND, AND COTTON PRODUCTION.

TABLE II.—ACREAGE AND PRODUCTION OF LEADING CROPS.

TABLE I.—AREA, POPULATION, TILLED LAND, AND COTTON PRODUCTION.

Counties.	Area.	POPULATION.						TILLED LAND.			COTTON PRODUCTION.					Cotton acreage per square mile.
		Total.	Male.	Female.	White.	Color'd.	Average per square mile.	Acres.	Per cent. in cotton.	Per cent. of county area.	Acres.	Bales.	Average per acre.			
													Bales.	Seed-cotton.	Lint.	
	Sq. mls.											475 *lbs.*		*Lbs.*	*Lbs.*	
The State	48,580	1,399,750	687,908	711,842	867,242	532,508	29	5,926,087	15.07	19.06	893,153	389,596	0.44	621	207	18.38
SEABOARD REGION.																
Currituck	282	6,476	3,337	3,139	4,495	1,981	23	40,455	0.78	22.41	316	189	0.44	627	209	1.12
Camden	214	6,274	3,133	3,141	3,791	2,483	29	35,870	7.44	26.20	2,670	823	0.31	438	146	12.48
Pasquotank	232	10,369	5,129	5,240	4,855	5,514	44	51,400	7.79	34.62	4,004	1,181	0.29	420	140	17.26
Perquimans	245	9,466	4,683	4,783	4,795	4,671	39	53,544	13.12	34.15	7,025	2,778	0.40	564	188	28.67
Chowan	150	7,900	3,822	4,078	3,633	4,267	53	35,234	17.16	36.72	6,047	2,223	0.37	525	175	40.31
Dare	382	3,243	1,650	1,593	2,875	368	8	2,094	7.63	0.86	16	8	0.50	714	238	0.04
Tyrrell	376	4,545	2,303	2,242	3,110	1,435	12	19,225	18.11	7.98	3,481	1,123	0.32	459	153	9.26
Washington	382	8,928	4,352	4,576	4,554	4,374	23	30,711	26.43	12.56	8,117	3,524	0.43	618	206	21.25
Hyde	557	7,765	3,948	3,817	4,424	3,341	14	32,167	7.81	9.02	2,513	718	0.29	408	136	4.51
Beaufort	620	17,474	8,701	8,773	10,022	7,452	28	43,625	27.01	10.99	11,785	6,021	0.51	729	243	19.01
Pamlico	470	6,323	3,125	3,198	4,207	2,116	13	16,989	25.20	5.65	4,585	2,226	0.49	693	231	9.76
Craven	820	19,729	9,351	10,378	6,664	13,065	24	50,853	25.25	9.68	12,838	5,782	0.45	642	214	15.66
Carteret	407	9,784	4,818	4,966	7,107	2,677	24	17,984	16.33	6.90	2,986	1,014	0.35	492	164	7.21
Jones	389	7,491	3,761	3,730	3,212	4,279	19	53,458	15.83	21.47	8,463	4,078	0.48	687	229	21.76
Onslow	645	9,829	4,916	4,913	6,600	3,229	15	56,120	11.86	13.59	6,658	2,841	0.43	609	203	10.32
Pender	889	12,468	6,309	6,159	5,509	6,959	14	38,156	8.83	6.71	1,463	835	0.57	813	271	1.65
New Hanover	182	21,376	9,935	11,441	8,159	13,217	117	7,396	1.92	6.35	142	66	0.46	663	221	0.78
Brunswick	814	9,389	4,769	4,620	5,337	4,052	12	18,006	2.14	3.46	385	244	0.63	903	301	0.47
Columbus	895	14,439	7,212	7,227	8,926	5,513	16	38,293	5.52	6.69	2,118	930	0.44	627	209	2.36
Total	8,951	193,268	95,254	98,014	102,275	90,993	22	641,580	13.34	11.20	85,557	36,554	0.43	609	203	9.56
LONG-LEAF PINE REGION.																
Gates	339	8,897	4,277	4,620	4,973	3,924	26	48,821	11.69	22.50	5,707	1,863	0.33	465	155	16.83
Hertford	376	11,843	5,816	6,027	5,122	6,721	31	53,625	27.24	22.28	14,605	6,360	0.44	621	207	30.86
Bertie	689	16,399	8,129	8,270	6,815	9,584	24	82,877	23.62	18.68	19,455	7,290	0.37	534	178	28.24
Northampton	557	20,032	9,920	10,112	7,987	12,045	36	96,565	37.51	27.09	36,219	13,616	0.38	537	179	65.02
Halifax	682	30,300	15,212	15,088	9,137	21,163	44	130,219	33.18	32.12	43,206	16,661	0.39	549	183	63.35
Nash	595	17,731	8,777	8,954	9,417	8,314	30	82,238	31.33	21.60	25,768	12,567	0.49	696	232	43.31
Edgecombe	567	26,181	13,130	13,051	7,968	18,213	46	182,875	39.27	36.62	51,880	26,250	0.51	720	240	91.50
Pitt	657	21,794	10,710	11,084	10,704	11,090	33	103,302	30.15	24.57	31,147	14,879	0.48	681	227	47.41
Greene	257	10,037	4,982	5,105	4,652	5,385	39	75,084	22.63	45.65	16,968	8,020	0.47	672	224	62.22
Martin	482	13,140	6,455	6,685	6,661	6,479	27	56,877	23.67	18.28	13,444	6,383	0.47	678	226	27.89
Wilson	376	16,064	7,958	8,106	8,655	7,409	43	65,255	36.33	27.12	23,706	13,049	0.55	783	261	63.05
Johnston	689	23,461	11,581	11,880	15,996	7,465	34	104,407	30.33	23.68	32,193	15,151	0.47	672	224	46.72
Wayne	601	24,951	12,308	12,643	12,827	12,124	42	122,102	26.29	31.74	32,103	14,558	0.45	645	215	53.42
Lenoir	457	15,344	7,502	7,842	7,277	8,067	34	83,943	22.82	28.72	19,150	8,235	0.43	612	204	41.90
Duplin	832	18,773	9,143	9,630	10,587	8,186	23	69,314	13.93	13.02	9,654	4,499	0.47	663	221	11.60
Sampson	964	22,894	11,187	11,707	13,347	9,547	24	116,892	13.13	18.95	15,346	6,291	0.41	585	195	15.92
Cumberland	982	23,836	11,493	12,343	12,594	11,242	26	54,238	16.98	8.63	9,210	3,905	0.42	603	201	9.38
Harnett	661	10,862	5,362	5,500	7,092	3,770	18	42,173	22.01	10.96	9,281	3,627	0.39	558	186	15.44
Moore	807	16,821	8,395	8,426	11,485	5,336	21	68,780	12.91	13.32	8,882	3,968	0.45	639	213	11.01
Richmond	826	18,245	8,963	9,282	8,141	10,104	22	75,268	33.48	14.24	25,198	12,754	0.51	720	240	30.51
Robeson	1,039	23,880	11,840	12,040	11,942	11,938	23	103,055	20.96	15.50	21,607	8,846	0.41	582	194	20.79
Bladen	1,026	16,158	7,954	8,204	7,598	8,560	16	37,990	4.26	5.79	1,618	683	0.42	603	201	1.57
Total	14,401	407,643	201,044	206,599	200,977	206,666	28	1,804,900	25.84	19.58	466,367	209,475	0.45	639	213	32.39
OAK UPLANDS REGION.																
Warren	507	22,619	11,234	11,385	6,386	16,233	45	83,864	25.76	25.84	21,603	7,728	0.36	513	171	42.61
Franklin	526	20,829	10,294	10,535	9,476	11,353	40	87,492	34.60	25.99	30,274	12,938	0.43	609	203	57.56
Granville	695	31,286	15,558	15,728	13,603	17,683	45	145,036	4.52	32.61	6,559	2,535	0.39	552	184	9.44
Wake	982	47,989	23,885	24,104	24,289	23,650	51	156,899	38.19	26.30	59,916	30,115	0.50	717	239	64.29
Orange	652	23,698	11,780	11,918	14,555	9,143	36	82,667	6.40	19.81	5,290	1,919	0.36	516	172	8.11
Chatham	826	23,453	11,416	12,037	15,560	7,953	28	119,185	11.30	22.55	13,478	5,858	0.43	618	206	16.33
Montgomery	489	9,374	4,616	4,758	6,857	2,517	19	46,209	14.11	14.77	6,519	2,989	0.46	654	218	13.33
Anson	545	17,994	8,712	9,282	8,790	9,204	33	88,293	32.05	25.31	28,296	11,857	0.42	597	199	51.92
Union	537	18,056	8,941	9,115	13,520	4,536	32	83,913	22.75	23.54	19,090	8,336	0.44	621	207	34.27
Stanley	432	10,505	5,119	5,386	9,166	1,339	24	58,628	10.02	21.21	5,878	2,475	0.42	600	200	13.60
Davidson	564	20,313	9,934	10,399	16,341	3,992	36	113,314	8.33	31.39	3,779	1,553	0.41	585	195	6.70
Rowan	482	19,965	9,633	10,332	13,621	6,344	41	94,378	12.34	30.59	10,645	4,381	0.41	585	195	22.08

TABLE I.—AREA, POPULATION, TILLED LAND, AND COTTON PRODUCTION—Continued.

Counties.	Area.	POPULATION.						TILLED LAND.			COTTON PRODUCTION.					Cotton acreage per square mile.
		Total.	Male.	Female.	White.	Color'd.	Average per square mile.	Acres.	Per cent. in cotton.	Per cent. of county area.	Acres.	Bales.	Average per acre.			
													Bales.	Seed-cotton.	Lint.	
OAK UPLANDS REGION—cont'd.	*Sq. mls.*											475 *lbs.*		*Lbs.*	*Lbs.*	
Cabarrus	370	14,964	7,358	7,606	9,849	5,115	40	80,439	23.90	33.97	19,224	7,467	0.39	552	184	51.69
Mecklenburg	576	34,175	17,027	17,148	17,922	16,253	59	134,028	30.85	36.36	41,343	19,129	0.46	660	220	71.78
Iredell	595	22,675	10,876	11,799	16,752	5,923	38	101,018	11.49	26.53	11,603	4,657	0.40	573	191	19.50
Catawba	445	14,946	7,153	7,793	12,469	2,477	34	75,350	7.00	26.46	5,175	2,012	0.39	555	185	11.63
Lincoln	295	11,061	5,341	5,720	8,180	2,881	37	53,571	13.89	28.37	7,442	2,945	0.40	564	188	25.23
Gaston	364	14,254	6,916	7,338	10,188	4,066	39	59,569	18.38	25.57	10,949	4,588	0.42	597	199	30.08
Cleaveland	464	16,571	8,022	8,549	13,700	2,871	36	85,752	22.43	28.88	19,238	6,126	0.32	453	151	41.46
Rutherford	520	15,198	7,234	7,964	11,910	3,288	29	63,825	15.16	19.18	9,679	2,079	0.21	306	102	18.61
Randolph	701	20,836	10,050	10,786	17,758	3,078	30	91,693	0.65	20.44	595	295	0.50	708	236	0.85
Guilford	682	23,585	11,322	12,263	16,885	6,700	35	126,722	0.22	28.10	283	114	0.40	573	191	0.42
Alamance	445	14,613	6,992	7,621	9,997	4,616	33	72,621	0.29	25.50	211	91	0.43	615	205	0.47
Person	401	13,719	6,692	7,027	7,206	6,513	34	71,634	.....	27.91	2	1	0.50	711	237	.....
Caswell	407	17,825	8,951	8,874	7,169	10,656	44	83,545	0.01	32.07	6	4	0.67	951	317	.....
Rockingham	582	21,744	10,770	10,974	12,431	9,313	37	77,439	0.01	20.79	5	3	0.60	855	285	.....
Stokes	476	15,353	7,554	7,799	11,730	3,623	32	53,369	0.02	17.52	13	7	0.54	768	256	0.03
Forsyth	364	18,070	8,832	9,238	13,441	4,629	50	59,157	0.03	25.39	16	10	0.63	891	297	0.04
Davie	289	11,096	5,396	5,700	7,770	3,326	38	59,272	1.33	32.05	790	302	0.38	546	182	2.73
Yadkin	351	12,420	5,954	6,466	10,876	1,544	35	52,816	0.16	23.51	87	26	0.30	426	142	0.25
Surry	476	15,302	7,504	7,798	13,227	2,075	32	69,011	.....	22.65	3	1	0.33	474	158	.....
Wilkes	626	19,181	9,089	10,092	17,257	1,924	31	80,512	0.13	20.10	107	29	0.27	387	129	0.17
Alexander	245	8,355	4,025	4,330	7,458	897	34	41,572	1.49	26.51	617	182	0.29	420	140	2.52
Caldwell	495	10,291	4,977	5,314	8,691	1,600	21	41,512	0.07	13.10	30	12	0.40	570	190	0.06
Burke	489	12,809	6,157	6,652	10,088	2,721	26	42,545	1.78	13.59	752	361	0.48	684	228	1.54
McDowell	545	9,836	4,847	4,989	7,939	1,897	18	34,798	0.07	9.98	23	9	0.39	558	186	0.04
Polk	257	5,062	2,493	2,569	3,918	1,144	20	21,027	7.83	12.78	1,646	362	0.22	312	104	6.40
Total	18,667	659,992	322,604	337,388	436,915	223,077	35	2,892,675	11.79	24.21	341,166	143,546	0.42	597	199	18.28
TRANSMONTANE REGION.																
Alleghany	276	5,486	2,760	2,726	4,967	519	20	46,198	.....	26.15	.....	.....	.....	.....	.....	.....
Ashe	370	14,437	7,249	7,188	13,471	966	39	70,207	.....	29.65	.....	.....	.....	.....	.....	.....
Watauga	370	8,160	4,022	4,138	7,746	414	22	44,753	0.02	18.89	10	3	0.30	429	143	0.03
Mitchell	401	9,435	4,666	4,769	8,932	503	24	31,975	0.05	12.46	15	6	0.40	570	190	0.04
Yancey	276	7,694	3,793	3,901	7,369	325	28	34,703	.....	19.65	.....	.....	.....	.....	.....	.....
Madison	457	12,810	6,468	6,342	12,351	459	28	57,490	0.02	19.66	12	4	0.33	474	158	0.03
Buncombe	614	21,909	10,938	10,971	18,422	3,487	36	77,628	.....	19.75	.....	.....	.....	.....	.....	.....
Henderson	351	10,281	5,019	5,262	8,893	1,388	29	38,595	0.03	17.18	10	4	0.40	570	190	0.03
Transylvania	382	5,340	2,682	2,658	4,823	517	14	17,967	.....	7.35	.....	.....	.....	.....	.....	.....
Haywood	582	10,271	5,097	5,174	9,787	484	18	40,474	.....	10.87	.....	.....	.....	.....	.....	.....
Jackson	532	7,343	3,643	3,700	6,591	752	14	28,606	0.06	8.40	16	6	0.38	534	178	0.03
Macon	539	8,064	3,932	4,132	7,395	669	15	32,630	.....	9.46	.....	.....	.....	.....	.....	.....
Swain	445	3,784	1,912	1,872	3,234	550	9	13,828	.....	4.86	.....	.....	.....	.....	.....	.....
Graham	307	2,335	1,155	1,180	2,123	212	8	8,212	.....	4.18	.....	.....	.....	.....	.....	.....
Clay	189	3,316	1,679	1,637	3,175	141	18	15,063	.....	12.45	.....	.....	.....	.....	.....	.....
Cherokee	470	8,182	3,991	4,191	7,796	386	17	28,603	.....	9.51	.....	.....	.....	.....	.....	.....
Total	6,561	138,847	69,006	69,841	127,075	11,772	21	586,932	0.01	13.95	63	23	0.36	516	172	0.96

TABLE II.—ACREAGE AND PRODUCTION OF LEADING CROPS.

Counties.	COTTON.		TOBACCO.		CORN.		SWEET POTATOES.		RICE.		OATS.	
	Acres.	Bales (475 lbs.).	Acres.	Pounds.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Pounds.	Acres.	Bushels.
The State	893,153	389,598	57,208	26,986,213	2,305,419	28,019,839	50,803	4,576,148	10,846	5,609,191	500,415	3,838,068
SEABOARD REGION.												
Currituck	316	139	.....	.....	23,310	324,819	462	42,902	58	7,727	267	2,734
Camden	2,670	823	.....	.....	23,663	295,447	377	26,823	86	16,861	1,008	8,854
Pasquotank	4,004	1,181	.....	.....	28,525	348,119	291	22,751	2	810	1,930	17,428
Perquimans	7,025	2,778	1	400	21,910	292,850	850	99,498	3	2,090	1,222	13,921
Chowan	6,047	2,223	1	398	13,877	143,156	723	62,247	.....	.....	791	6,888
Dare	16	8	.....	.....	956	11,205	293	19,717	7	2,780	17	230
Tyrrell	3,481	1,123	.....	.....	8,300	108,839	460	31,739	503	237,515	781	7,622
Washington	8,117	3,524	4	685	15,824	217,631	479	48,429	87	60,873	1,065	13,427
Hyde	2,513	718	4	517	21,632	243,623	261	20,236	1,016	304,671	1,354	18,400
Beaufort	11,785	6,021	17	5,263	20,225	286,211	1,693	188,507	979	502,676	1,895	18,436
Pamlico	4,585	2,226	12	1,520	6,381	107,959	783	65,807	394	276,174	378	4,845
Craven	12,838	5,782	6	2,732	19,001	218,256	1,323	115,538	438	251,108	333	4,426
Carteret	2,936	1,014	1	303	5,156	41,458	834	61,469	413	206,965	107	1,122
Jones	8,463	4,078	1	250	19,425	186,954	435	38,287	321	118,777	455	5,426
Onslow	6,658	2,841	2	730	23,259	185,019	765	67,980	159	92,565	96	1,280
Pender	1,463	835	3	690	16,550	159,064	1,522	116,559	392	248,622	183	2,269
New Hanover	142	66	.....	.....	2,008	15,937	316	23,138	315	260,068	86	606
Brunswick	385	244	7	2,502	4,915	46,329	1,523	111,779	1,489	1,163,852	240	2,262
Columbus	2,113	930	15	3,866	15,723	136,546	2,242	186,306	1,201	462,042	267	2,517
Total	85,557	36,554	74	19,856	290,640	3,369,422	15,632	1,349,712	7,863	4,216,176	11,975	132,708
LONG-LEAF PINE REGION.												
Gates	5,707	1,863	3	620	21,946	170,642	972	87,494	.....	.....	1,210	10,016
Hertford	14,605	6,360	7	2,160	25,521	236,088	483	76,439	.....	.....	1,800	14,512
Bertie	19,455	7,290	2	554	37,735	345,091	890	94,473	.....	.....	2,403	20,517
Northampton	36,219	13,616	36	20,484	45,224	431,581	596	67,858	.....	.....	4,805	45,769
Halifax	43,206	16,661	21	8,487	44,790	437,321	543	52,709	.....	.....	4,497	41,771
Nash	25,768	12,567	27	7,562	32,490	295,619	848	93,997	.....	.....	3,875	30,135
Edgecombe	51,880	26,250	3	550	46,235	433,214	823	86,033	17	2,901	9,589	94,021
Pitt	31,147	14,879	3	598	46,482	458,166	1,171	82,334	161	110,067	3,301	29,406
Greene	16,988	8,020	8	1,955	25,148	173,421	429	37,660	35	19,214	1,738	16,772
Martin	13,444	6,383	1	211	24,209	227,445	829	92,913	11	3,150	1,447	11,229
Wilson	23,706	13,049	17	8,745	27,288	299,957	525	58,336	6	1,800	1,590	13,682
Johnston	32,193	15,151	36	12,881	45,045	428,996	1,916	210,456	36	19,672	3,176	29,958
Wayne	32,103	14,558	198	102,979	44,469	466,432	1,347	120,581	567	294,201	1,779	18,600
Lenoir	19,150	8,235	45	13,500	29,238	274,010	584	50,995	208	95,559	1,060	12,217
Duplin	9,654	4,499	16	4,655	36,813	330,437	1,842	169,044	629	300,203	433	6,132
Sampson	15,346	6,291	28	14,352	53,951	486,768	1,997	214,596	441	240,086	654	6,297
Cumberland	9,210	3,905	.....	.....	32,677	282,423	1,116	91,355	42	19,963	1,509	13,701
Harnett	9,281	3,627	32	9,510	21,244	180,458	962	96,118	1	330	1,202	7,640
Moore	8,882	3,988	70	15,724	27,934	302,196	716	65,018	.....	.....	7,924	48,744
Richmond	25,198	12,754	6	1,305	29,562	277,974	750	65,374	38	17,460	3,571	32,279
Robeson	21,607	8,846	2	577	49,961	360,128	1,825	167,225	303	118,393	2,814	22,845
Bladen	1,618	683	6	1,040	21,556	188,208	1,554	117,638	473	146,340	362	3,795
Total	466,367	209,475	567	228,449	770,058	7,086,575	22,718	2,198,646	2,908	1,383,839	60,739	530,128
OAK UPLANDS REGION.												
Warren	21,603	7,778	1,759	992,256	28,457	293,773	383	28,782	.....	.....	5,559	46,090
Franklin	30,274	12,838	118	58,932	32,642	338,239	498	48,684	.....	.....	5,560	45,812
Granville	6,559	2,535	8,941	4,606,358	42,608	515,159	686	52,307	.....	.....	14,344	110,690
Wake	59,916	30,115	230	94,354	53,172	612,869	1,797	155,260	.....	.....	13,948	98,062
Orange	5,290	1,919	2,323	1,178,732	28,542	366,640	261	22,360	.....	.....	12,243	86,268
Chatham	13,478	5,858	141	49,837	43,087	558,281	622	53,334	.....	.....	19,861	120,841
Montgomery	6,519	2,989	54	14,370	18,090	210,521	231	21,849	.....	.....	7,852	50,248
Anson	28,296	11,857	11	4,880	29,121	305,139	499	39,645	.....	.....	8,999	72,454
Union	19,090	8,336	9	3,467	28,877	338,520	222	19,218	.....	.....	14,357	101,719
Stanley	5,878	2,475	8	1,735	22,426	271,877	113	10,376	.....	.....	10,975	72,223
Davidson	8,779	1,553	484	260,538	36,983	549,906	390	30,665	.....	.....	16,924	122,063
Rowan	10,645	4,381	216	115,251	38,963	597,519	277	25,452	.....	.....	17,751	142,121
Cabarrus	19,224	7,467	12	3,239	26,831	381,321	120	11,241	.....	.....	7,592	54,519
Mecklenburg	41,343	19,129	10	2,291	41,285	539,385	281	26,393	.....	.....	12,949	94,356
Iredell	11,603	4,657	465	242,714	39,264	588,220	182	11,601	.....	.....	17,488	126,429

TABLE II.—ACREAGE AND PRODUCTION OF LEADING CROPS—Continued.

Counties.	COTTON.		TOBACCO.		CORN.		SWEET POTATOES.		RICE.		OATS.	
	Acres.	Bales (475 lbs.).	Acres.	Pounds.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Pounds.	Acres.	Bushels.
OAK UPLANDS REGION—continued.												
Catawba	5,175	2,012	49	26,380	21,248	358,210	205	19,325	.....	.....	7,566	64,236
Lincoln	7,442	2,945	15	6,085	19,338	313,907	126	19,179	1	1,230	6,313	44,989
Gaston	10,949	4,588	7	2,180	24,678	373,472	187	19,290	.....	.....	6,699	50,244
Cleaveland	19,238	6,126	23	5,122	31,339	390,281	399	35,834	1	885	10,959	62,211
Rutherford	9,679	2,079	38	12,908	32,783	394,062	343	28,226	1	609	6,166	31,971
Randolph	595	295	45	11,101	35,338	477,168	257	19,809	.....	.....	13,524	88,380
Guilford	283	114	910	422,716	39,790	519,185	188	20,302	.....	.....	20,774	129,723
Alamance	211	91	1,688	695,013	24,628	305,874	139	13,252	.....	.....	9,618	48,869
Person	2	1	5,868	3,012,387	19,372	241,523	152	12,843	.....	.....	9,821	56,926
Caswell	6	4	10,174	4,336,664	25,663	361,641	469	24,629	.....	.....	14,441	101,396
Rockingham	5	3	9,332	4,341,259	25,175	392,767	273	27,911	.....	.....	15,209	139,266
Stokes	13	7	4,690	2,131,161	19,969	338,781	334	19,860	.....	.....	8,408	72,391
Forsyth	16	10	1,693	822,788	20,920	335,164	227	18,447	.....	.....	11,780	95,304
Davie	790	302	1,205	633,339	22,125	438,595	65	6,231	.....	.....	13,366	139,126
Yadkin	87	26	425	177,595	21,735	343,070	102	8,266	.....	.....	11,289	79,443
Surry	3	1	2,136	905,250	25,334	397,143	407	24,669	.....	.....	9,199	70,737
Wilkes	107	29	110	33,211	34,865	486,089	268	22,255	.....	.....	8,240	55,360
Alexander	617	182	28	11,799	16,789	212,382	92	9,237	.....	.....	7,503	51,752
Caldwell	30	12	75	25,384	17,315	274,495	216	21,071	2	1,649	3,886	30,592
Burke	752	361	58	20,079	22,613	325,656	138	11,858	8	4,308	3,455	21,762
McDowell	23	9	100	30,541	17,675	265,934	115	12,707	2	545	1,690	13,111
Polk	1,646	362	4	931	10,632	139,315	93	5,116	.....	.....	877	5,786
Total	341,166	143,546	53,454	25,292,847	1,039,672	14,146,083	11,546	957,484	15	9,176	387,176	2,797,822
TRANSMONTANE REGION.												
Alleghany	.....	.....	8	2,049	7,201	122,587	3	285	.....	.....	1,933	19,365
Ashe	.....	.....	60	11,664	15,616	277,027	4	411	.....	.....	3,357	37,955
Watauga	10	3	23	7,219	8,227	148,204	7	769	.....	.....	1,828	28,205
Mitchell	15	6	77	29,647	11,894	209,131	35	2,661	.....	.....	3,990	40,845
Yancey	.....	.....	84	33,898	11,200	205,650	26	2,113	.....	.....	3,657	43,631
Madison	12	4	1,626	807,911	17,816	348,858	25	1,764	.....	.....	4,238	38,816
Buncombe	.....	.....	947	475,428	29,108	490,544	87	5,872	.....	.....	6,967	62,679
Henderson	10	4	29	4,087	16,407	227,411	40	2,627	.....	.....	2,908	23,087
Transylvania	.....	.....	10	3,858	9,762	154,769	34	3,446	.....	.....	257	2,870
Haywood	.....	.....	100	39,516	17,254	314,446	36	2,405	.....	.....	4,099	35,834
Jackson	16	6	21	4,801	12,793	188,521	131	10,278	.....	.....	1,521	9,440
Macon	.....	.....	46	9,154	14,423	222,855	102	11,214	.....	.....	1,621	12,209
Swain	.....	.....	11	1,166	6,809	100,543	21	2,154	.....	.....	757	4,301
Graham	.....	.....	4	1,095	4,222	66,092	89	5,460	.....	.....	628	3,914
Clay	.....	.....	25	5,771	7,810	113,462	109	7,058	.....	.....	1,230	7,607
Cherokee	.....	.....	42	8,411	14,507	227,650	158	11,789	.....	.....	1,534	11,657
Total	63	23	3,113	1,445,061	205,049	3,417,750	907	70,806	.....	.....	40,525	377,415

PART I.

PHYSICO-GEOGRAPHICAL AND AGRICULTURAL DESCRIPTION

OF

NORTH CAROLINA.

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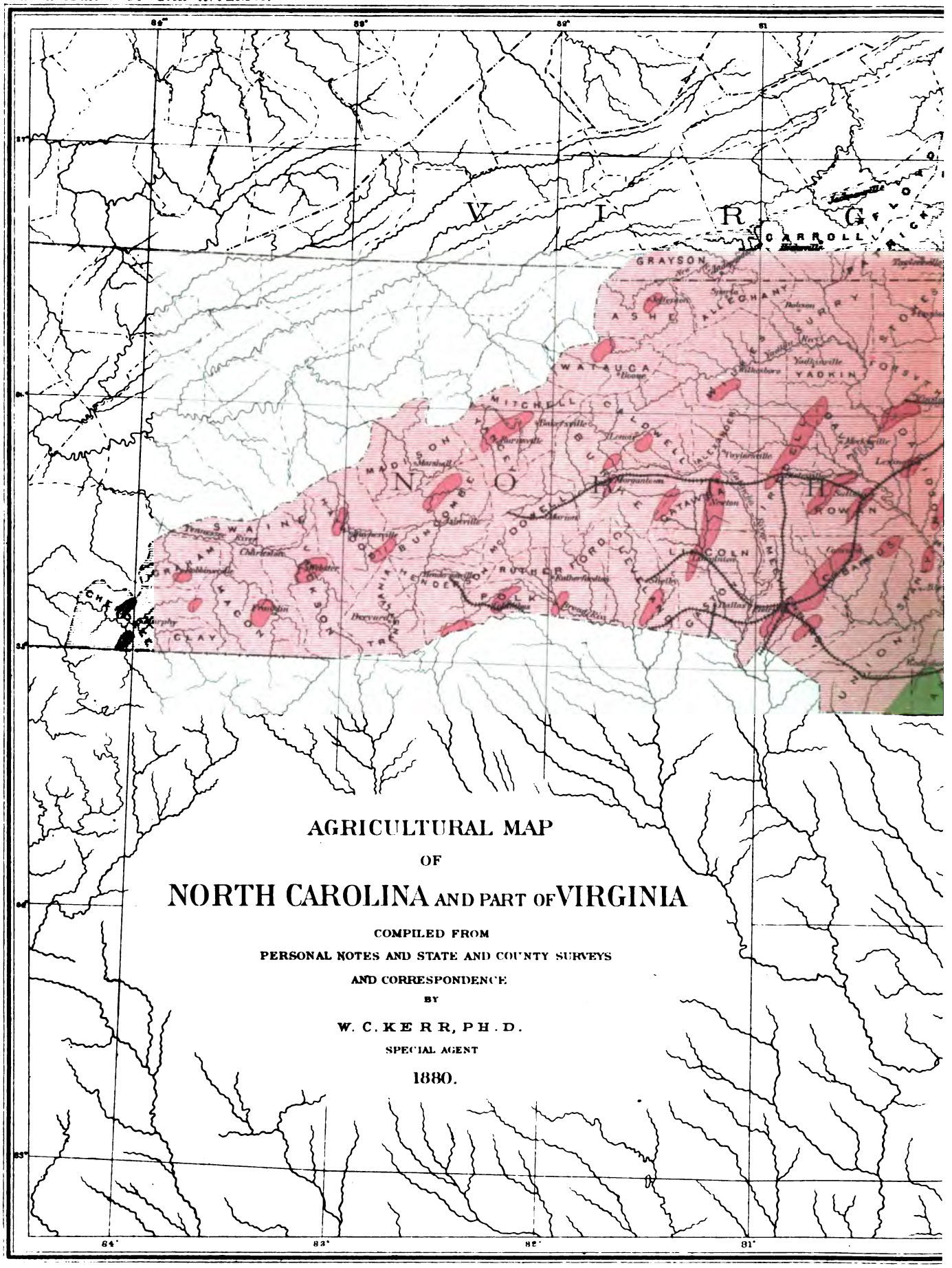
DEPARTMENT OF THE INTERIOR



AGRICULTURAL MAP

OF

NORTH CAROLINA AND PART OF VIRGINIA

COMPILED FROM

PERSONAL NOTES AND STATE AND COUNTY SURVEYS

AND CORRESPONDENCE

BY

W. C. KERR, PH. D.

SPECIAL AGENT

1880.

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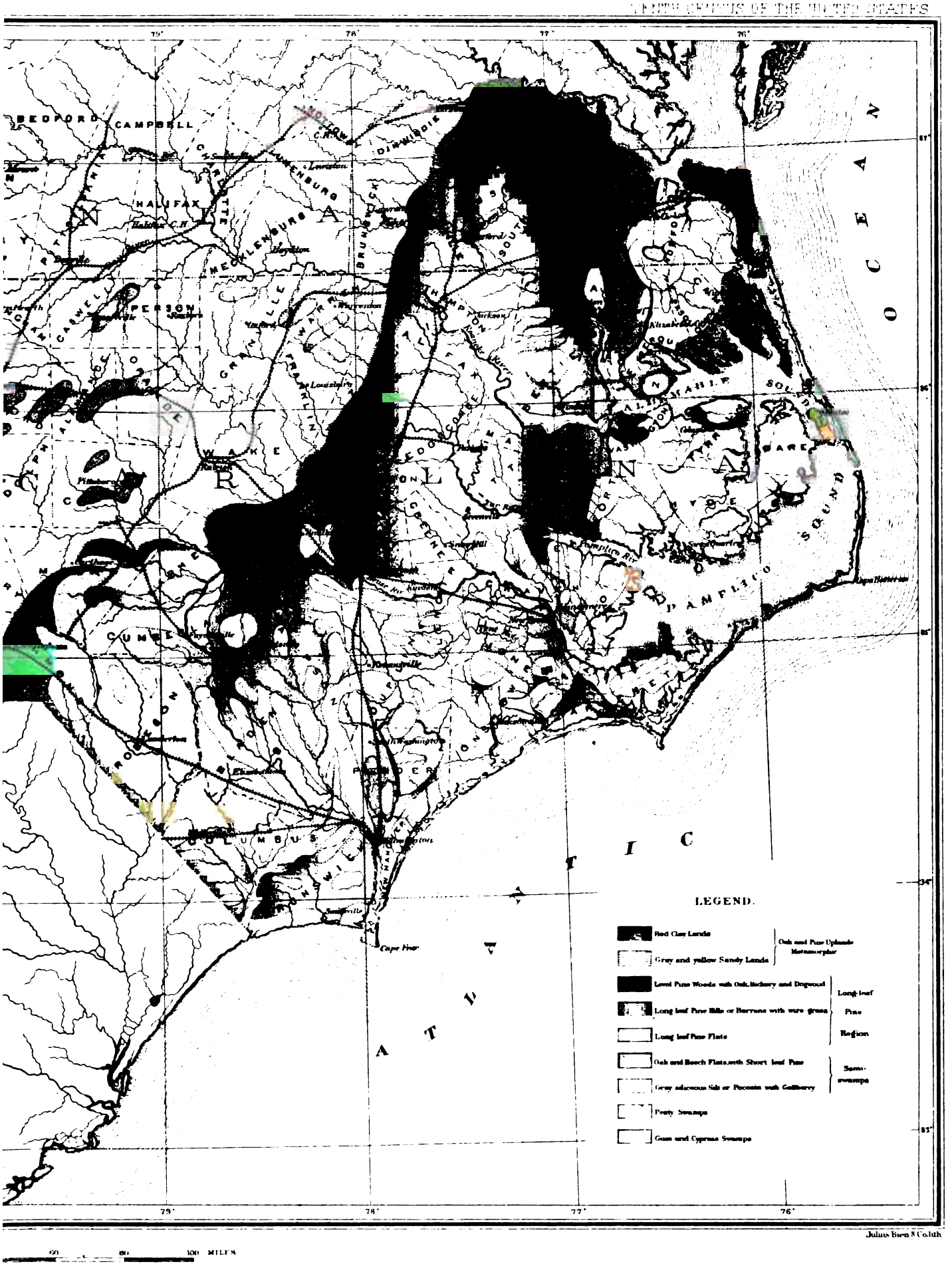

Julius Bien & Co. lith

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OUTLINES OF THE PHYSICAL GEOGRAPHY

OF THE

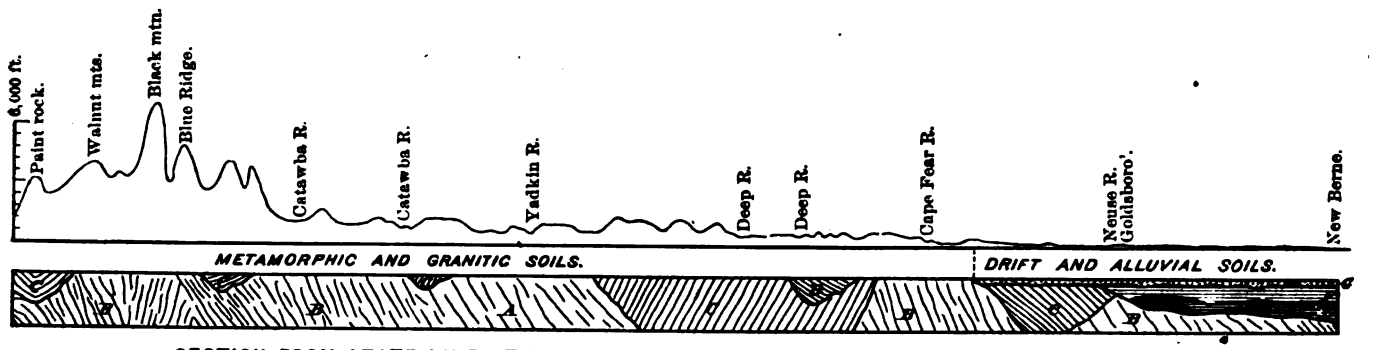
STATE OF NORTH CAROLINA.

North Carolina lies east and west across the Atlantic slope of the Appalachians in a long, narrow, rudely triangular belt, its narrow western end resting on the highest plateau and summit of that continental system of mountains, and its eastern broader end spread out in a low, level, and gently undulating plain on the sea-coast. Its length east and west is 500 miles; its mean breadth about 100 miles, the western extremity being only 15 miles wide, while its broadest part, near the sea-coast, in the meridian of Wilmington and Cape Fear river, reaches a breadth of 187½ miles. This state is situated between the meridians of 75° 27′ and 84° 20′ west longitude and 33° 50′ and 36° 33¼′ north latitude, and about midway between the great lakes of the north and the Gulf of Mexico. If on a map of the United States the map of this state was detached, and its western end swung northward on its easternmost point as a pivot, the western extremity would touch the north shore of lake Ontario; swung southward it would reach the Gulf.

The area of the state is 52,250 square miles, of which 3,670 is water surface, leaving a land surface of 48,580 square miles.

TOPOGRAPHY.—The ascent of the Atlantic slope from the sea is very gradual in the latitude of this state, more so than in the states north and south. The obvious reason is that the greater elevation of the mountains here is more than compensated by the notable protrusion of the coast-line of this state into the sea. If on a map of the United States a straight line be drawn from Saint Augustine, Florida, to Sandy Hook, it will pass more than 100 miles west of the eastern cape of North Carolina. If, then, the ascent of this slope be followed westward from the easternmost point of the coast-line along a median parallel, it will be found that for the first 100 miles the rise is but little more than half a foot to the mile; for the second 100 miles it is only 3½ feet; for the third 100 miles 5 feet; and for the last 75 miles, to the foot of the Blue Ridge, 8 feet per mile; aggregating 1,500 feet in 375 miles. If the steepest ascent be taken in a northwest direction at right angles to the trend of the coast and of the Appalachians (which is about N. 60° E.) the first hundred miles give a rise of 200 feet, or nearly 2 feet to the mile, and the acclivity for the next 130 miles, to the foot of the Blue Ridge, is 10 feet per mile, making 1,500 feet in 250 miles.

The cismontane plateau rises from an elevation of 1,000 feet on the east to 1,500 feet along its western border, where it is quite rough and mountainous. The Blue Ridge is an escarpment of from 1,500 to 2,000 feet average elevation above the plateau at its base, rising in some of its peaks to nearly 6,000 feet of absolute elevation. The region west of this chain is a long, narrow, elevated mountainous plateau, bounded westward by the high and massive range of the Smoky mountains.



SECTION FROM STATE LINE AT FRENCH BROAD WATER GAP TO SEA LEVEL AT NEW BERNE.

A, granite; B, gneiss and schist; C, metamorphic slates; D, Triassic sandstones; E, Cretaceous greensand; F, Tertiary sands, clays, and limestones; G, Quaternary sands and clays.

TOPOGRAPHICAL DIVISIONS.—From the preceding statement it is obvious that, topographically, the state is naturally divided into four regions, or zones, parallel to each other and to the Appalachian axis and the coast, viz, *Eastern*, *Midland*, *Piedmont*, and *Mountain divisions*.

The Eastern division.—This division extends from 110 to 125 miles inland from the coast to the lower falls of the rivers, rising very gradually to about 200 feet along its northwestern border, a little less toward the north, and a little more to the southward. This boundary is clearly enough defined by a straight line from Weldon, on the Roanoke river, to the point where the Yadkin (or Pedee) river crosses the southern border of the state. The total area is nearly 24,000 square miles; land surface, 20,000 square miles; and it may be described summarily in a single word as one broad *champaign*. Its surface is nearly level or slightly undulating, except along the river courses, on the upper reaches of which are found bluffs and hills. The rivers from the interior cross it in a transverse direction, dividing it into half a dozen broad, flat swells, which sink down toward the coast to within a few feet of tide-level. The region is further characterized by numerous and large sounds, bays, and wide tidal rivers, by extensive swamps and marshes, and by wide tracts of alluvial and peaty soils, with extensive cypress and juniper forests near the coast, and of sandy soils inland having vast forests of long-leaf pine.

The Midland division rises toward its western limit to about 1,000 feet, and has an average elevation of about 650 feet. Its breadth is nearly 100 miles, and its area some 15,000 square miles. The surface is generally hilly and rolling, and sometimes quite rough near the larger rivers, which have cut their valleys in a southeasterly course across it often to depths of 200, 300, and 400 feet below the level of the broad-backed swells or table-lands between them. This and the two following divisions are regions of oak forests and granitic soils.

The Piedmont division.—This plateau slopes up from 1,000 to 1,200 and 1,500 feet at the foot of the Blue Ridge, having an average elevation of near 1,200 feet. It is from 60 to 70 miles wide, and has an area of about 7,000 square miles. Its surface is generally hilly, and often rugged, especially toward the western side, where numerous high and precipitous spurs project eastward and southward from the Blue Ridge. Two of these, the South mountains and the Brushy mountains, traverse almost its entire breadth in a nearly east direction, that is, diagonally, and throw off many secondary spurs and ridges, thus carrying its mountainous features to the borders of the midland division. These spurs frequently rise to an elevation of 1,000 and 1,500 feet and more above the intervening valleys. In this region rise most of the great rivers already referred to, whose waters have so profoundly modified the topography of the two preceding divisions.

The Mountain division.—This is a high plateau, bounded eastward by the straggling, irregular, knobby chain of the Blue Ridge, which attains its greatest elevation of almost 6,000 feet midway of the state. Its average elevation is nearly 4,000 feet, most of its gaps being above 3,000 feet; but toward the southern and northern borders of the state it drops to an altitude of near 3,000 feet, its lower gaps being but little above 2,000 feet. Seen from the east, this chain presents the aspect of a steep and rugged escarpment springing suddenly from the Piedmont plateau to an altitude of 2,000 and 3,000 feet and more above it, while from the west it appears as a low and very ill-defined range of scattered and irregular knobs and ridges of the moderate elevation of 1,000 or 2,000 feet above that plateau, which itself has an average altitude of about 2,700 feet, its valleys being 2,000 feet, and its higher tables and benches reaching 3,500 and 4,000 feet. The western boundary of this division is that of the state; that is, the Smoky mountains. The area of this division is 5,700 square miles. These two parallel bounding chains are separated by from 30 to 50 miles, but at the Grandfather plateau they approach within 10 miles, diverging again northward.

This plateau is the culminating region of the Appalachian system, and contains not only its heaviest masses, but its highest summits, Mitchell's peak, in the Black mountains, being 400 feet higher than Mount Washington, and a dozen other peaks surpassing that summit of the White mountains, and it is therefore the most elevated region of the United States east of the Mississippi river. It is traversed north and south by half a dozen cross chains, which are in some cases higher than either of the principal ranges, some of them being more than 6,000 feet, the Black, with Mitchell's peak, 6,688 feet, being one of these cross chains.

The plateau is thus subdivided into a number of smaller plateaus or basins, bounded on all sides by high mountains, having each its own independent system of drainage. The Blue Ridge being the divide between the waters of the Atlantic and the Mississippi, all the rivers of this region, except those which rise north of the Grandfather plateau, flow northwestward into the Tennessee river, the New river (Kanawha) flowing northeastward and reaching the Mississippi by way of the Ohio.

CLIMATE.—The geographical position of this state, together with its topographical features, give at once the controlling conditions of its climate. Its situation would give a middle temperate climate. The position of its eastern end on the Atlantic, and the projection of this end southward along the coast below the parallel of 34°, together with its near approach to the Gulf Stream, which hugs the shore closely at this point, give this part of the state a subtropical character. The isotherm of this southern angle is 66°, the same as that of southern Alabama, middle Mississippi, and middle Texas, while the great elevation and inland recession of the western section bring its climate within the cold temperate zone, the isotherm for this region corresponding to that of middle New England and Upper Canada, although it is not subject to the same extremes of either heat or cold, the range of temperature being less by from 5° to 12°. The average mean annual temperature for the state is 59°; for the eastern region, 61°; the middle, 58°; the western, 52°. The summer temperatures are, respectively, 77° for the state, and 79°, 77°, and 70° for the several regions; the winter temperatures for the state, 43°, and for the regions, 46°, 44°, 38°, respectively. The hottest month is July, and the coldest December.

The average annual *rainfall* for the whole state is 52 inches; for the east, middle, and western portions, 60, 45, and 58 inches, respectively. This rainfall is distributed pretty uniformly through the year, except that August shows a considerable excess of precipitation in the eastern and middle regions and February in the western; and the summer rainfall exceeds that of the other seasons considerably in the eastern and very slightly in the middle, while the amounts for the winter and summer are nearly equal in the west, autumn being the driest season in all sections.

The *prevalent winds* in all sections of the state are from the west, but most notably in the western section; and of the westerly winds, the southwest is the more common in the eastern division, the northwest in the middle division, and the west in the mountain region. The next in order of importance, except in the western division of the state, is the northeast wind. The east wind has no prominence in any quarter of the state, nor has the southeast wind, except on the immediate coast, and the south wind, except in the eastern section, is equally unimportant.

The winds which bring rain are mostly southwesterly. Thunder-storms come generally from the west, winter rains frequently from the northeast, and in all seasons occasional rains, and sometimes very heavy ones, come from the east and southeast. These statements will need modification for special localities, particularly in inclosed mountain valleys, where the direction of the rain-bearing winds is governed by the local topography. In some of these the west is the rainy quarter; in others the east; and in still others the southeast.

The average annual snowfall is 5 inches in the middle region, 2 inches in the east, and 14 inches in the west. The snow-clouds come generally from the northeast, sometimes from the north, and rarely from the southwest.

GEOLOGICAL FEATURES.—The eastern topographical division is mantled over with a thin covering of *Quaternary* gravels, sands, and clays, having a thickness of one, two, or three score feet, being entirely removed in many places, and thinning out toward its northwestern margin. Underneath this formation is the *Tertiary*, of no greater thickness or persistence. *Miocene* clays, sands, and shell-beds (the so-called marls) crop out in the depressions and along the streams over nearly the whole breadth of the division, and in the southern half of it *Eocene* calcareous clays, chalk-beds, and shell limestones show themselves in the river beds and bluffs, occasionally coming to the surface elsewhere in the lower levels of the region. As we ascend the courses of the rivers, Cape Fear for example, the Eocene is represented by beds of lignitic clay, and then of sand and gravel and of purple and white kaolin clays. This formation is limited in thickness like the preceding, and thins out toward the coast, as well as inland.

The Cretaceous is seen only in the beds of a few of the larger rivers south of the Neuse, and usually only in the lower parts of the bluffs at low water. This formation is represented by loose and half-compacted greensands, with occasional shell-beds. Toward the northwestern limit of the division the upturned edges of the Archæan rocks, gneisses, slates, and quartzites appear in the beds and banks of the rivers from the Roanoke to the Pedee, and occasionally project above the sands and gravels at other points between. Along this margin of the division, and touching it near the Pedee, on the southern border of the state, and again at the forks of the Cape Fear, lies a narrow strip of *Triassic* rocks, red and gray sandstones, clays and conglomerates, with several seams of bituminous coal, one of them 6 feet thick and of good quality. These rocks are tilted toward the southeast at an angle of from 10° to 30°. The average breadth of the belt is 5 or 6 miles, which widens to 12 miles between Raleigh and the University and thins out toward the northern border of the state. The coal outcrop follows the course of Deep river about 30 miles. These rocks lie in a trough along the eroded edges of the nearly vertical Archæan slates and schists. This Triassic terrane is repeated in all its features along the northern border of the state, occupying a similar trough of from 2 to 4 miles in width along the upper valley of Dan river, extending from a point near Danville to 40 miles west. The dips here are reversed, being northward, and are much steeper—from 30° to 50° and 70°. The coal of this terrane is semi-bituminous, and the longer bed is only half as thick as that of the Deep River belt. Over the whole surface of the state west of the Quaternary, except these two Triassic tracts of less than 1,000 square miles and two or three small patches of primordial on the western border, the *Archæan* rocks alone have place. As the covering of sand and gravel disappears a zone of gneisses and schists is uncovered in the region of Raleigh, which is exposed from the northern border of the state, on the Roanoke river, southwestward to the Cape Fear, beyond which it is overlaid by the Quaternary. The dips are still easterly, as in the outcrops through the sand. A few miles west of Raleigh, and at the forks of the Cape Fear and the point where the Pedee crosses the southern border, the great central *slate belt* succeeds with its steep regular *westerly* dips. This is one of the most extensive, conspicuous, and well characterized terranes in the state, and occupies a regular broad zone quite across the middle of the state, its breadth varying from 25 to 40 miles. These rocks consist of a variety of slates—argillite, chlorite, quartzite, conglomerate, graphite, and pyrophyllite. West of this comes a zone of granites and gneisses, with obscure and confused structure and stratification, but with easterly dips. Beyond this granite belt the whole western region of the state is occupied by a great body of gneisses and mica-schists, interrupted by three narrow belts of slates and quartzites and limestones: one, irregular and broken, near the eastern border of the terrane (*e. g.*, King's mountain); the second along the Blue Ridge; the third along the Smoky mountains on the western border. The dip of the first belt is west; of the second, east; of the third, east and west. The rocks of this zone are much broken and disturbed, and the dips very variable in amount, but almost uniformly east. West of the Blue Ridge the gneisses are coarser,

more massive, and thick-bedded, and also more tilted and broken. They are conspicuously characterized by numerous and very large veins or dikes of very coarse granite, in which have been opened many valuable mica mines.

The whole Archæan formation in the state is metalliferous, containing large bodies of magnetic iron ore and hematites, and gold and copper ores in all its zones from east to west. They have yielded also a notable number of gems, and the species of minerals, many of them of great rarity, number 180.

AGRICULTURAL REGIONS.—The agricultural regions do not correspond with the topographical divisions. The eastern division is subdivided agriculturally into two subordinate regions. That which lies next the coast may be denominated the *seaboard region*. This is a region of swamps and savannas and wide alluvial tracts and semi-swamps, as also of oak, pine, and beech flats. Its elevation above tide is limited to 5 or 10 feet for the most part, only occasionally rising to 15 or 20 feet. It includes also tracts of marsh on the shores of the sounds and the margins of long-leaf pine ridges, and the sea-shore is formed by a narrow fringe of sand islands, which separate the sounds from the sea.

The second region, which lies next westward, may be described as the *long-leaf pine region*. The soils of this region are predominantly sandy. It includes the soils characterized as "sand-hills or pine barrens" and the level "upland piny-woods soils", the growth of the former being almost exclusively long-leaf pine, with a scrub growth of black-jack oak and scattered tufts of wire-grass, and that of the latter long-leaf pine, mingled with the short-leaf species (*Pinus tæda* and *P. scrotina*), oaks, hickory, dogwood, etc., its soil being a gray sandy loam. There are also large tracts of long-leaf pine flats and mixed long- and short-leaf pine and oak flats with similar soils, but of finer and closer texture.

The two next topographical divisions (Midland and Piedmont) may be included in one agricultural region, viz, *the oak uplands region*, and the western division will be called the *transmontane region*. From the description before given of the geology of these two regions of the state it is evident that the soils are of every variety of texture and composition, corresponding to the whole wide range of the metamorphic or Archæan rocks. They may be grouped in a general description under the designation of gray and yellow sandy and gravelly loams and red-clay soils. The subsoil, generally yellow or red clay, is occasionally gray sandy or gravelly loam, and in the bottoms often pipe-clay. In general, it may be stated that wherever the underlying rocks are hornblendic, composed of syenite, hornblende schist, or trap, the soils are red or mulatto or chocolate-colored and clayey.

THE SEABOARD REGION.

This region abounds in lakes, bays, rivers, and sounds. Its water surface covers upward of 3,000 square miles. That portion which lies between the two great sounds, Albemarle and Pamlico, covers an area of above 2,000 square miles, only a small part of which rises more than 10 feet above tide, a large portion being below 5 feet. The major part of this intersound tract, formerly called *Alligator swamp*, is swamp, peat, and marsh land. There are several lakes in the interior of this swamp which are bordered by narrow fringes of rich black-loam soil of inexhaustible fertility. These lakes are, or were, covered with a heavy growth of gum (tupelo), cypress, ash, maple, etc. The more peaty and untillable tracts abound in cypress and juniper, and have long furnished the markets of the continent with these timbers, while those lying next the sounds and rivers are frequently semi-swamps or oak, beech, and pine flats, and have a rich gray or ash-colored clay-loam soil. That portion of the seaboard region which lies northward of Albemarle sound consists mainly of low-lying, level, clay-loam lands or semi-swamps, which are heavily timbered with oaks, hickory, ash, maple, and short-leaf pine (*Pinus tæda*), often passing into cypress and juniper swamps along the rivers and into the great *Dismal swamp*, which lies partly in this state.

These lands, when cleared and drained, resemble the prairie lands of the northwest, and equal them in fertility. Along the ridges or swells between the bay-like rivers of this section are narrow tracts of sandy soil with long-leaf pine growth. A large part of this Albemarle section also lies below the level of 10 feet above tide. Similar tracts to those above described, that is to say, oak and pine flats, are found lying also near the bays and water-courses and fringing the swamps in the southern parts of the seaboard region along the coast to the South Carolina line.

The tops of the higher swells of land between the great rivers of this region, and sometimes the slopes and lower levels, are frequently occupied by the description of swamp land known as "pocoson". These have for the most part a close, impervious, fine sandy, gray or ash-colored soil, with patches of cold, stiff brick-clay and of black soil composed of coarse sand and vegetable matter. The subsoil is of the same texture, with a little clay, and is of a yellowish color. The pocoson is commonly covered with a scattered or clumpy growth of scrub pine (pond pine, *P. scrotina*), with clumps of white bay or with copses of gallberry bushes and bramble vines and tufts of wire-grass and broom-sedge, and an occasional loblolly pine (*P. tæda*), and are quite valueless. The pocoson lands occupying this topographical position are the sources of the tributaries of the rivers, and are flat and covered with water more than half the year, but are dry and cracked in summer. They are usually fringed about with narrow, irregular strips of canebrake or gum and cypress swamps of dark loamy soils, and with oak flats, which have gray clay-loam soils. These border tracts are very fertile.

The savanna is another type of soil, and is found here and there among the pocosons and pine flats in patches of from a few hundred acres to 3 or 4 square miles in extent. These savannas are very flat and treeless, and are covered with grass. The soil is wet, cold, close, fine sandy, often black with humus; the subsoil is yellowish, with more clay.

On or near the highest parts of the divides or water-sheds are frequently found small lakes of 3 or 4 to 15 or 20 square miles. In this case there is commonly a margin, of varying width, of rich swamp (gum and cypress) lands next the lakes. There are also here and there throughout the region narrow belts of long-leaf pine and sandy land, which frequently reach the coast south of Pamlico.

A most notable feature of the region is the fringe of linear sand islands, called "The Banks", that wall off the Atlantic along the entire coast. These constitute, in fact, an almost continuous sand-dune, broken here and there by narrow inlets, having a breadth of from a few rods to a half mile or more, narrowing occasionally to a mere low beach, over which the waves break into the sound, and again widening to 1 or 2 miles, as at Hatteras, and to 3 or 4 miles opposite Albemarle sound. This dune, or sand wave, is moving inland, the fine particles being continually carried over into the sounds, converting their outer margins into marsh, and gradually adding these to their own breadth. The average elevation of the crests of these islands, which are generally next to the sounds, is only a few feet or yards above high tide, but they are commonly broken into rounded hillocks 25, 30, and 40 feet high. Opposite Roanoke island these hillocks rise to a height of 75 and 90 feet, and in front of Albemarle sound they exceed 100 feet. Here they are quite bare, and rise in great waves, which are continually shifting their places, moving in a southwest direction at the rate of from 1 to 3 feet per annum. These islands were originally, and are still here and there, covered with forests of small oaks, hickory, short-leaf pine, dogwood, etc., and in many parts with red cedar and live oak and the noted evergreen shrub, cassena, or yaupon. The dwarf palmetto is found in the white-oak flats south of Pamlico and in the region of the Cape Fear, and as far up as Hatteras the larger species (sabal palmetto) thrives.

A very small proportion of the area of the seaboard region is adapted to cotton, not more than 100 bales being produced in some counties, and the whole product of the region does not reach 37,000 bales. The chief crops are corn, wheat, sweet potatoes, peanuts, and rice, and latterly, in many sections, vegetables and Irish potatoes for the northern market. Lumbering in pine, cypress, and juniper and turpentine-getting have long been among the most important industries. The shad and herring fisheries are conducted on an immense scale, often with seines 1¼ miles long worked by steam, and the taking of other species of fish carries this form of industry through nearly the whole year. The region abounds in natural pasturage, and is well adapted to cattle and sheep raising.

The following analyses, made for the North Carolina geological survey by Messrs. Bogardus and Hanna, are given of samples of the different classes of soils of the seaboard region:

1. SOILS OF GUM AND CYPRESS SWAMPS.—All these are fine corn soils, but will not grow cotton, as it runs to weed and never matures:

No. 21. *Dark mucky, porous soil* on the southern margin of Mattamuskeet lake, in Hyde county; 6 feet deep. The mineral matter is in a state of very fine comminution. Timber growth, gum (tupelo), cypress, ash, poplar (*Liriodendron*), etc. The land produces from 50 to 60 bushels of corn to the acre (Emmons).

No. 22. *Dark mucky, porous soil* from the north side of Mattamuskeet lake, Hyde county; same depth, growth, etc. Fields alongside those from which the samples were taken have produced from 50 to 60 bushels of corn to the acre for more than 100 years without manure or change of crop (Emmons).

No. 23. *Dark mucky, porous soil*, 3 to 4 feet deep, with same growth, from a large swamp on Blount's creek, on the south side of Pamlico river, 12 miles from Washington, Beaufort county; sample taken 1 foot deep.

No. 24. *Dark muck and porous soil*, 2 feet deep, from Bear swamp, in Pamlico county.

No. 25. *Cypress and gum swamp soil*, near the southern border of White Oak swamp, Jones county, 2 to 4 feet deep. Produces 50 bushels of corn to the acre.

No. 26. *Black mucky soil*, 5 to 10 and 15 feet deep, from Big swamp, on the border of Bladen and Robeson counties; a tract of 30,000 acres. Timber growth same as No. 21.

No. 27. *Black and mucky soil* from swamp on Eagle's island, across the Cape Fear river from Wilmington, Brunswick county, of many fathoms depth. Growth, gum, cypress, cane; an inexhaustible rice soil.

No. 28. *Black and mucky soil* from a field cultivated in rice 100 years, which borders No. 27.

2. SOILS OF SEMI-SWAMPS, AND OF OAK, BEECH, AND PINE FLATS.

No. 29. *Dark gray soil (semi-swamp)* from margin of Bear swamp, Pamlico county; depth, 2 feet; the subsoil is lighter colored and sandy. Growth, gum, (tupelo and sweet), poplar, maple, and ash. This is a good cotton land, and much of it occurs in this county and region.

No. 30. *Dark gray and gravelly loam* from beech flat at Stonewall, south side of Bay river, Pamlico county. Growth, beech, gum, maple, and oak. This is an excellent cotton and corn land, and makes a bale to the acre. Large bodies of this description of land occur in the county.

No. 31. *Light-gray to ash-colored soil* from a white oak flat half a mile wide at the head of North river, on the southern border of Open Ground Prairie swamp, in Carteret county. Growth, white oak, gum, maple, short-leaf pine (*P. tæda*), and dwarf palmetto. This soil represents extensive bodies of land on the borders of this and all the great swamps south and west of this point, and is a good corn and cotton land.

No. 32. *Gray light loamy soil* from semi-swamp near Morehead City, Carteret county. Growth same as in No. 29, and like that in appearance and adaptations

No. 33. *Gray gravelly soil of oak flat* near Whiteville, Columbus county, taken 1 foot deep. Growth, willow oak, ash, sweet and black gums, poplar, and maple. This soil represents a great area of land in the region on the borders of the swamp, and is a good cotton and corn soil.

No. 34. *Dark-gray and ash-colored soil* of Dover pocoson, flat and wet, Craven county; dark gray and ash-colored, and has a growth of scrubby pine, wire-grass, and low thicketty brush. This soil has a close, fine texture, and is as impervious as clay. This is a common type of pocoson, but often the sand is coarse and the vegetable matter runs up to 80 and 90 per cent., in which case the growth is gallberry and scrub pine, with clumps of white bay bushes and brambles.

No. 35. *Savanna soil*, Beaufort county, near Pungo river, a level prairie of 4 or 5 square miles, flat, treeless, and covered with grass. This soil is gray to yellowish in color, has a close, fine texture, and is almost impervious to water.

No. 36. *Soil of Burgaw savanna*, in Pender county, 25 miles north of Wilmington. This soil is like the last, and is nearly as extensive. It is dark colored, with a yellowish, more clayey subsoil. Both this and No. 35 are fair soils when drained.

Gum and cypress swamp lands.

	Hyde county.		Beaufort county.	Pamlico county.	Jones county.	Bladen county.	Brunswick county.	
	Lake Mattamuskeet.		Blount Creek swamp.	Bear swamp.	White Oak swamp.	Big swamp.	Eagle's Island.	
	South side.	North side.						
	Soil.	Soil.	Soil.	Soil.	Soil.	Soil.	Soil.	Cultivated soil.
	No. 21.	No. 22.	No. 23.	No. 24.	No. 25.	No. 26.	No. 27.	No. 28.
Insoluble residue	43.00	34.60	59.24	71.30	64.74	52.20	32.36	62.22
Soluble silica	0.03 } 43.03	0.40 } 35.00	1.86 } 61.10	5.90 } 77.20	3.60 } 68.34			
Potash	0.16	0.18	0.79	0.08	0.05	0.60	0.96	0.46
Soda	0.18	0.10	0.69	.....	0.02	.....	0.26	.....
Lime	0.12	0.27	1.62	0.12	0.10	1.16	0.56	1.54
Magnesia	0.12	0.27	1.08	0.13	0.29	0.55	.....	0.23
Peroxide of iron	} 6.40	{ 3.70	} 13.78	{ 1.39	0.30	} 6.09	4.92	20.35
Alumina	}	{ 5.10	}	{ 1.23	3.33	}		
Phosphoric acid	0.30	0.12	.....	0.06	0.06	0.34	0.45	Trace.
Sulphuric acid	0.04	.....	0.22	.....	0.21	0.65	1.30	0.23
Organic matter	47.10	38.80	20.80	17.50	22.80	} 38.41	59.19	12.43
Water	.....	12.36	.....	2.30	4.20			
Total	97.45	95.84	100.08	100.01	99.70	100.00	100.00	97.46

Semi-swamps, oak, beech, and pine flats.

	Pamlico county.		Carteret county.		Columbus county.
	Bear swamp.	Bay River.	Prairie swamp.	Near Morehead.	Near Whiteville.
	Soil.	Soil.	Soil.	Soil.	Soil.
	No. 29.	No. 30.	No. 31.	No. 32.	No. 33.
Insoluble residue	62.64	69.28	80.84	69.07	85.15
Soluble silica	3.86 } 66.50	12.05 } 81.33	3.70 } 84.54	6.80 } 75.87	1.57 } 86.72
Potash	0.90	0.24	0.07	0.07	Trace.
Soda	0.68	.....	0.02	.....	0.45
Lime	0.68	0.29	0.44	0.20	1.67
Magnesia	0.58	0.09	0.22	0.07	0.38
Peroxide of iron	} 10.30	{ 1.46	1.18	1.12	} 5.12
Alumina		{ 4.90	2.69	4.25	
Phosphoric acid	Trace.	0.04	0.08	0.13	0.02
Sulphuric acid	0.43	0.03	0.06	0.08	0.03
Organic matter	} 19.60	{ 9.60	7.70	13.00	4.41
Water		{ 2.10	2.50	4.80	1.32
Total	99.67	100.08	99.50	99.59	100.12

Sandy pine barrens.—Those portions of this region which are properly characterized by the term "sand-hills", or "pine barrens", lie for the most part in the southern half of the belt. The rivers which traverse and the water-courses which rise in it are frequently bordered by wide tracts of from 1 to 3 and 5 miles' breadth of cypress swamp, which is characterized by a deep black peaty soil, and by a growth of cypress, gum, ash, and maple, and often of cane. These soils, when drained, are of the greatest fertility and durability. The soils of the sand-hills are almost pure sand, and are of extreme infertility. This description of soil occupies a comparatively small proportion of the whole area.

The sandy soil is generally only from a few inches to 1 or 2 feet deep, occasionally 3 or 4 feet, and is commonly underlaid by a yellow or brown sandy or gravelly subsoil; but sometimes there are mere alternations of beds of different colored sands to unknown depths, and in other cases, at a depth of 8 or 10 feet or more, are half-compacted sandy and gravelly earths, gray and yellow, in which the channels of the streams are cut with steep, canal-like, often vertical banks.

The forests are usually open and park-like, with tufts of wire-grass and occasional patches of tufted broom-sedge (*andropogon*); but often there is an undergrowth of small black-jack and other worthless species of oak.

In the midst of the largest bodies of sand-hill lands there are occasional tracts of a fair grade of cultivable land, generally found on or near the water-courses. The sand-hill soils proper will produce almost nothing; they furnish, however, a scanty pasturage in the swampy tracts which abound along the numerous sluggish streams. The yaupon and the scuppernong grape flourish even in these sand wastes.

Nearly all the lands of this description are found on the waters of the Cape Fear south of the Neuse, and in the southern half of the belt. Only a few small tracts lie north of this section.

The cotton product of this *pine-hill* or *sand-hill* section proper is very small, not exceeding 20,000 bales. The rivers and creeks of this region often have wide tracts of bottom land, or are flanked by swamps or oak and pine flats, and on these are made crops of corn, potatoes, and rice. Cotton is grown on the better class of uplands of mixed oaks and pines, which are interspersed among the sandy tracts.

Level and rolling upland piny woods.—The common type of land of the long-leaf pine region may be characterized as level and rolling piny uplands, the soil being a gray to yellow sandy loam, sometimes clayey or silty, with a forest growth of long- and short-leaf pines, oaks, hickory, dogwood, etc. These lands are of medium fertility, easily drained and cultivated, and constitute the great body of the most valuable cotton lands of the state. Most of the long-leaf pine belt north of the Neuse is of this character, and here one-half of the cotton of the state is made—one-third of it in a dozen counties.

The subsoil is commonly a yellow sandy or gravelly clay, which is found at a depth of from 5 to 8 or 10, and sometimes 20 inches or more. The growth, as stated, is composed of long-leaf pines as the predominant element of the forests, generally mixed with short-leaf pines (which sometimes almost or quite replace them) and with a subordinate oak forest, which changes its character with the changing topography and texture of the soil. In the better grades of rolling and yellow-loam lands hickory and dogwood enter largely, and on the flatter tracts, with their close ash-colored soil, sweet gum, maple, and elm become prominent.

Pine flats.—In some portions of this region, chiefly in the section lying north of the Neuse river and parallel to it, there are wide stretches of open long-leaf pine woods, with a few scattered oaks of small size and stunted gums and low huckleberry bushes, wire-grass, and broom-sedge. The surface is very level, and is interspersed with frequent swampy patches, having a scrubby growth of bay, maple, gallberry, myrtle, and other swamp jungle. The soil is an ash-colored silty clay, with alternating patches of sandy soil, underlaid by a gray stiff clay or fine sand and clay equally impervious. These flats are very unproductive, and are valuable only for turpentine and lumber. North of the Roanoke, lying partly in Bertie and partly in Hertford counties, there is another large body of land of the same character.

Another class of pine flats, more properly pine and oak flats, differs from the ordinary level pine woods in having a more clayey soil, commonly ash-colored, with a clay subsoil, and a frequent large admixture of short-leaf (slash) pine, with post oak and white oak, and are usually more productive and more durable. These tracts generally lie near water-courses. A good example of this description of land is found in Scotland Neck, Halifax county, on Kehukee creek. The typical pine flats, however, have a forest growth almost exclusively of long-leaf pine, sometimes with a few scattered small oaks, post oak and black oak, or a scattered scrubby undergrowth, with a soil and subsoil as above described. These lands are of fair quality, and produce well when properly drained. A good example may be seen about Selma and eastward in Johnston county, and also on Six Runs creek, in Sampson county.

The following analyses (made for the Census Office) are given of samples of the lands of this region:

No. 11. *Light gray soil* from near Sparta, Edgecombe county. Depth taken, 3 inches; growth, long-leaf pine, small oaks, and dogwood. This is a fair type of the "piny-woods cotton land", is easily cultivated, and is naturally poor, but by composting will produce 1,200 pounds of seed-cotton per acre.

No. 12. *Subsoil* of the above, light yellowish in color, from 10 to 15 inches deep, and underlaid by a brick clay.

No. 13. *Gray sandy loam soil* from Penny Hill, Pitt county, taken 11 inches. Growth, long-leaf pine, oak, hickory, and dogwood; the trees are tall and straight. This is the best cotton land of the level piny woods, and "stands well, wet or dry."

No. 14. *Subsoil* of the above, a tenacious clay.

[The extremely sandy and droughty soil (Nos. 11 and 12) shows, on the whole, a higher phosphate percentage than might be looked for; but the low percentages of potash and lime and their decrease (instead of the usual increase) downward speaks of little durability. Nevertheless, the application of some lime or marl would here also be followed by good results. Potash manures would probably also help at once.

The surface soil from Pitt county (No. 13) is of good composition as regards the chiefly important elements; but the subsoil of tenacious gray clay, poorer than the surface soil in lime and phosphates, is against it, and shows the need of liming and the use of the subsoil plow.

The land represented by Nos. 15 and 16 is a degree below No. 11, and like it suffers a decrease of plant-food as the depth increases, even as to phosphates. Potash and lime are very low, the phosphates relatively more abundant. The use of lime or marl is here again the first improvement called for; then manure in the widest sense.

In the case of Nos. 17 and 18, the depth of the material designated as subsoil not being given, the arable stratum would appear to be of good composition, except as regards lime, which, relatively to potash and phosphoric acid, is very deficient. Liming ought to increase greatly the production of this soil, which promises fair durability.

The Wilson county soil (No. 19) appears exceptionally poor, especially in lime, it being probably droughty and shallow, its quality decreasing downward.

The Lousin swamp soil is exceptionally poor in potash, but, being doubtless of considerable depth, has a relatively large proportion of lime and phosphoric acid for so sandy a soil.

The pine-flat soil (No. 37), if the analysis represents it correctly, stands only in need of a dressing of superphosphate to render it fairly productive, lime being abundant and potash in adequate supply, while phosphoric acid is very deficient.—E. W. H.]

Toward the western limit of the long-leaf pine belt, where it rises to an elevation of 150 and 200 feet, especially near the streams, the surface is frequently broken and hilly, and has a larger intermixture of short-leaf pine, oaks, and hickory in its forests. Its soils are also of a more open and gravelly texture, and on the slopes near the watercourses is a brown or yellow clay loam, having a predominant growth of oaks, so that this narrow, irregular border tract furnishes a zone of passage from the features of the long-leaf pine region into those of the oak uplands.

Besides the prevalent characteristic forest trees above mentioned there are found, both in the long-leaf pine and seaboard regions, magnolia grandiflora, several species of elm, and, near the southeast shore, live oak and two species of palmetto.

It remains to mention that almost the whole of the long-leaf pine belt and a large part of the seaboard region are underlaid by deposits of shell marl, and the southern half by chalk marl and greensand, which crop out in the river banks and in the ravines, and are often reached by the farm ditches. These deposits are highly calcareous, and contain valuable percentages of phosphates and alkalies, and are commonly uncompacted; and being thus widely distributed, are of immense value to the agriculture of the region. So obvious is their utility that the advancement of agriculture and the cotton product in the several counties may be measured by the number of tons of marl used.

Besides its large crops of cotton this long-leaf pine region produces on a large scale corn, pease, and sweet potatoes, and in a few counties rice and tobacco.

THE OAK UPLANDS REGION.(a)

The third agricultural subdivision, *the oak uplands region*, extending from the western limit of the pine belt to the Blue Ridge, contains, as before stated, every imaginable variety of soil.

The different descriptions of soils usually lie in narrow parallel northeast and southwest belts or zones conformable to the geological structure of the country. Those of this part of the state may be characterized generally as gray, yellow, and brown loams, the higher levels and ridges having more commonly sandy and gravelly loam soils, gray, yellow, or brown, and there are interspersed throughout the region belts and patches of red-clay lands wherever hornblendic or trap rocks outcrop. These are generally among the best soils, both as to fertility and durability, and are covered with a heavy growth of oaks, hickory, walnut, etc., pines being absent. The growth of the region generally eastward of the Blue Ridge consists of a great variety of oaks, and hickory, maple, poplar, dogwood, sourwood, and sassafras, with occasional belts of chestnut and chestnut oak on the higher ridges and white pine and hemlock in the foot-hills of the mountains and in the higher coves and gorges. Along the rivers, as well as along the smaller streams, even to the smallest brook, are found patches, and often extensive tracts, of "bottom lands" of fine alluvial soils, which constitute the meadow lands, as well as the most productive and reliable corn lands of the region. These *bottom lands* constitute probably one-tenth of the cultivated area of most of the counties throughout the region. The second bottoms and higher benches or terraces along many of the larger rivers are sometimes of considerable extent, and are very productive; but they are more sandy and less durable than the bottoms proper.

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a Corresponds to the Metamorphic of the Georgia report.

The highly ferruginous plateau soil from near Raleigh (Nos. 3 and 4) shows in its subsoil a considerable superiority over the gray soils as to potash and phosphoric acid, but is notably deficient in lime, dressings of which, or of marl, would doubtless act very favorably in connection with deep tillage. The deficiency in lime is here, as elsewhere, indicated by the prevalence of pine.

The Spartanburgh soil and subsoil (Nos. 5 and 6) are again remarkable for deficiency in lime, and are evidently closely related to the plateau soil (Nos. 3 and 4) from near Raleigh, the chief difference being the higher percentage of phosphoric acid in the surface soil. But here again liming or marling is indicated as the first improvement needed.

The soil from near Charlotte (Nos. 7 and 8) shows a remarkable superiority over the preceding in the percentages of phosphates, which are high in both soil and subsoil and show ample cause for the higher production, which could doubtless, however, be increased by liming or marling, lime being still deficient for a soil of this character.

The soil from Cabarrus (Nos. 9 and 10) also (taking soil and subsoil together) shows a high phosphate percentage; and, being associated with a good supply of lime, the soil should be both productive and durable with deep and thorough tillage.

In all of these soils potash is rather low.—E. W. H.]

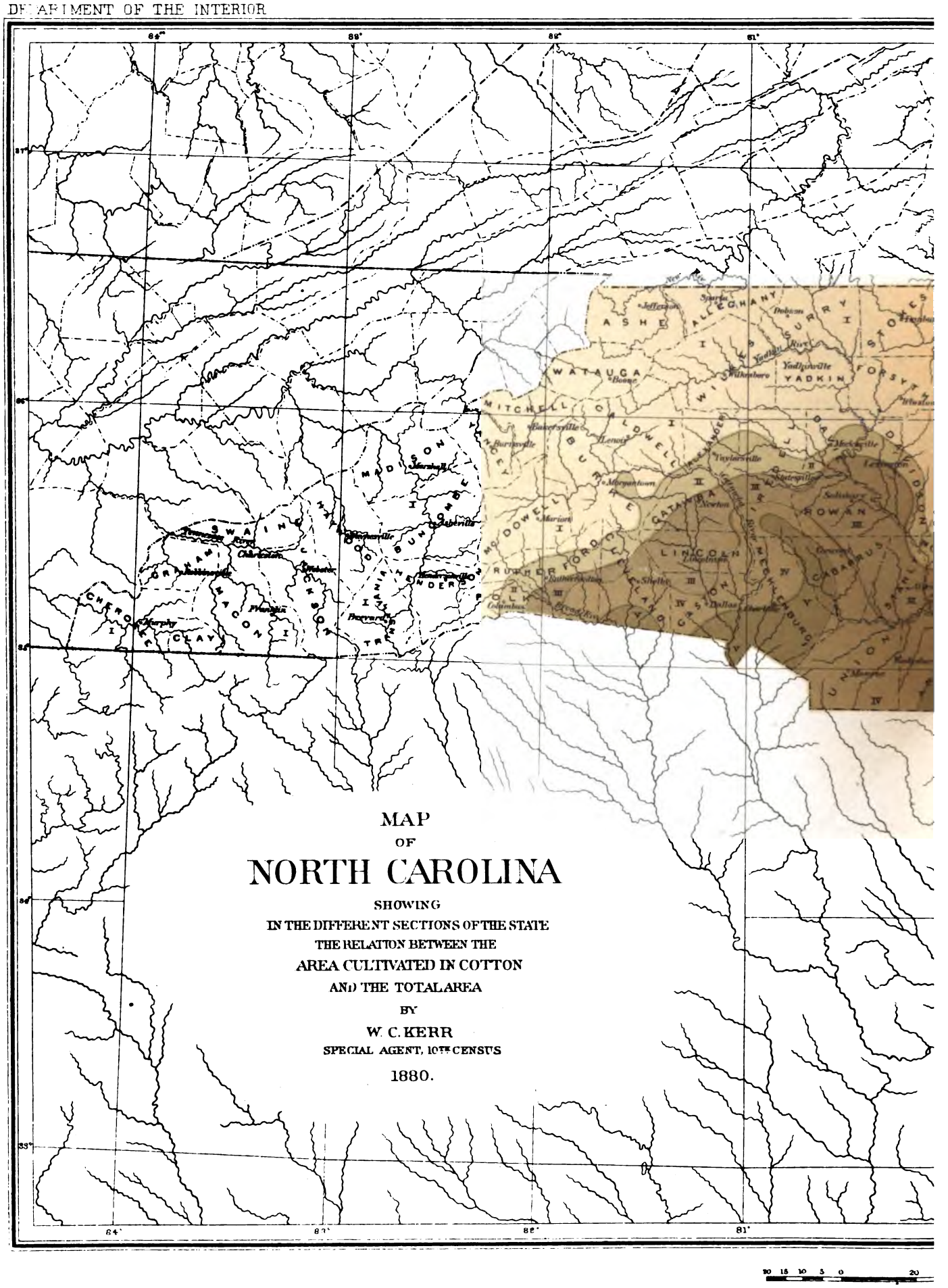
THE TRANSMONTANE REGION.

The western division of the state beyond the Blue Ridge is entitled to be considered and described as a separate agricultural region, on account of the marked difference of climate which distinguishes it from the cismontane divisions, inasmuch as its agricultural features and capabilities are differentiated strongly from those of the other divisions by its climate, although there is no difference in the soils, either as to origin or physical and chemical qualities. On the high table-land between the Blue Ridge and the Smoky, in addition to the growth of oak, poplar, maple, etc., there is a large intermixture of white pine, hemlock, walnut, cherry, linn (*Tilia Americana*), chestnut, buckeye, magnolia of several species, sugar maple, and black locust; and the summits of the higher ranges above the level of 5,000 feet, as the Black, the Balsam, and the highest parts of the Smoky mountains, are frequently mantled over with a dense growth of spruce and fir. The soils of this region extend over the summits of the higher mountains, and are often of the greatest fertility quite to their tops, which are consequently heavily wooded. The flattish or dome-like summits of a few of the higher and more massive mountains are bare of trees, and are covered with grass; are, in fact, natural meadows or prairies. A marked feature of the forests of this region is the occurrence of extensive thickets or jungles of laurel (*Rhododendron*), both on the valley flats and the mountain benches and slopes, and even on the summits of some of the highest ranges, as the Roan and Craggy, where these thickets cover many square miles. The "ivy" (*Kalmia latifolia*) is commonly associated with the laurel, and sometimes replaces it. These shrubs attain here the size of forest trees, being often 10 and even 15 inches in diameter and from 15 to 20 feet high.

The valleys or troughs between the cross-chains are generally deep and narrow, but in some cases they open out into broad stretches of hilly and rolling country, with occasional tracts of river bottoms and benches or terraces, sometimes three or four, rising one above another and shouldering back against the flanking river hills. The soils of the bottoms are usually ash-colored or gray clays or loams, and are very productive, while the higher terraces are more sandy and less durable. This description applies especially to valley plateaus of the upper French Broad and of Valley river. Most of these basins are deep and narrow, and their surfaces are broken by projections of the inclosing mountains, so that but a small proportion of the surface of many of these transmontane counties is arable. The slopes and spurs of the mountains, however, and generally even their summits, produce crops of native grasses, and timothy and blue-grass and other cultivated varieties catch easily and become naturalized and self-propagating.

The proper agriculture, therefore, for the region is stock-raising, to which, indeed, nine-tenths of it had been devoted until the war. Large crops of corn are grown on the river bottoms, while wheat, oats, rye, and buckwheat is grown on the hills and mountain sides. This region is the natural home of the vine, of which it has furnished several valuable native varieties. The apple, pear, and peach also flourish with remarkable vigor and vitality. The culture of the gold-leaf tobacco has been domesticated in several of these transmontane counties within the past decade, and one of them, Madison, already markets a million pounds per annum. The timber of the region also furnishes the basis of considerable commerce, which is rapidly increasing with the recent penetration of several lines of railway. Immense quantities of walnut, as well as of black locust and cherry, are already finding their way to market.

DEPARTMENT OF THE INTERIOR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STOKES
SURRY
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RUTHERFORD
LINCOLN
GASTON
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HENDERSON
TRANSYLVANIA
BUNCOMBE
MADISON
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HAYWOOD
SWAIN
GRAHAM
CHEROKEE
CLAY
MACON
JACKSON
Jefferson
Boone
Wilkesboro
Yadkinville
Lenoir
Taylorsville
Morganton
Statesville
Salisbury
Marion
Newton
Lincolnton
Shelby
Rutherfordton
Columbus
Dallas
Gastonia
Concord
Monroe
Asheville
Hendersonville
Brevard
Waynesville
Sylva
Murphy
Franklin
Hayesville
Burnsville
Bakersville
Mocksville
Greensboro
Reidsville
Danbury
Dobson
Elkin
Mount Airy
Winston-Salem
Thomasville
High Point
Lexington
Albemarle
Charlotte
Pineville
Matthews
Mineral Springs
Wadesboro
Monroe
Rockingham
Hamlet
Laurinburg
Lumberton
Fayetteville
Wilmington
Smithfield
Goldsboro
Kinston
Tarboro
Rocky Mount
Roanoke Rapids
Weldon
Scotland Neck
Halifax
Enfield
Louisburg
Warrenton
Henderson
Oxford
Durham
Hillsborough
Chapel Hill
Pittsboro
Carthage
Sanford
Lillington
Raleigh
Wake Forest
Franklinton
Oxford
Roxboro
Yanceyville
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Davidson
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Wilkes
Alexander
Iredell
Mecklenburg
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Cleveland
Rutherford
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Henderson
Transylvania
Buncombe
Madison
Yancey
Mitchell
Avery
Watauga
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Alleghany
Wilkes
Caldwell
Burke
McDowell
Catawba
Iredell
Cabarrus
Union
Anson
Richmond
Scotland
Robeson
Cumberland
Harnett
Johnston
Wayne
Lenoir
Greene
Pitt
Edgecombe
Nash
Wilson
Franklin
Vance
Warren
Granville
Person
Orange
Chatham
Lee
Moore
Montgomery
Stanly
Randolph
Guilford
Alamance
Caswell
Rockingham
Swain
Graham
Cherokee
Clay
Macon
Jackson
Haywood
Sampson
Duplin
Onslow
Jones
Craven
Pamlico
Carteret
Hyde
Tyrrell
Dare
Currituck
Camden
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Northampton
Halifax
Martin
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Washington
Tyrrell
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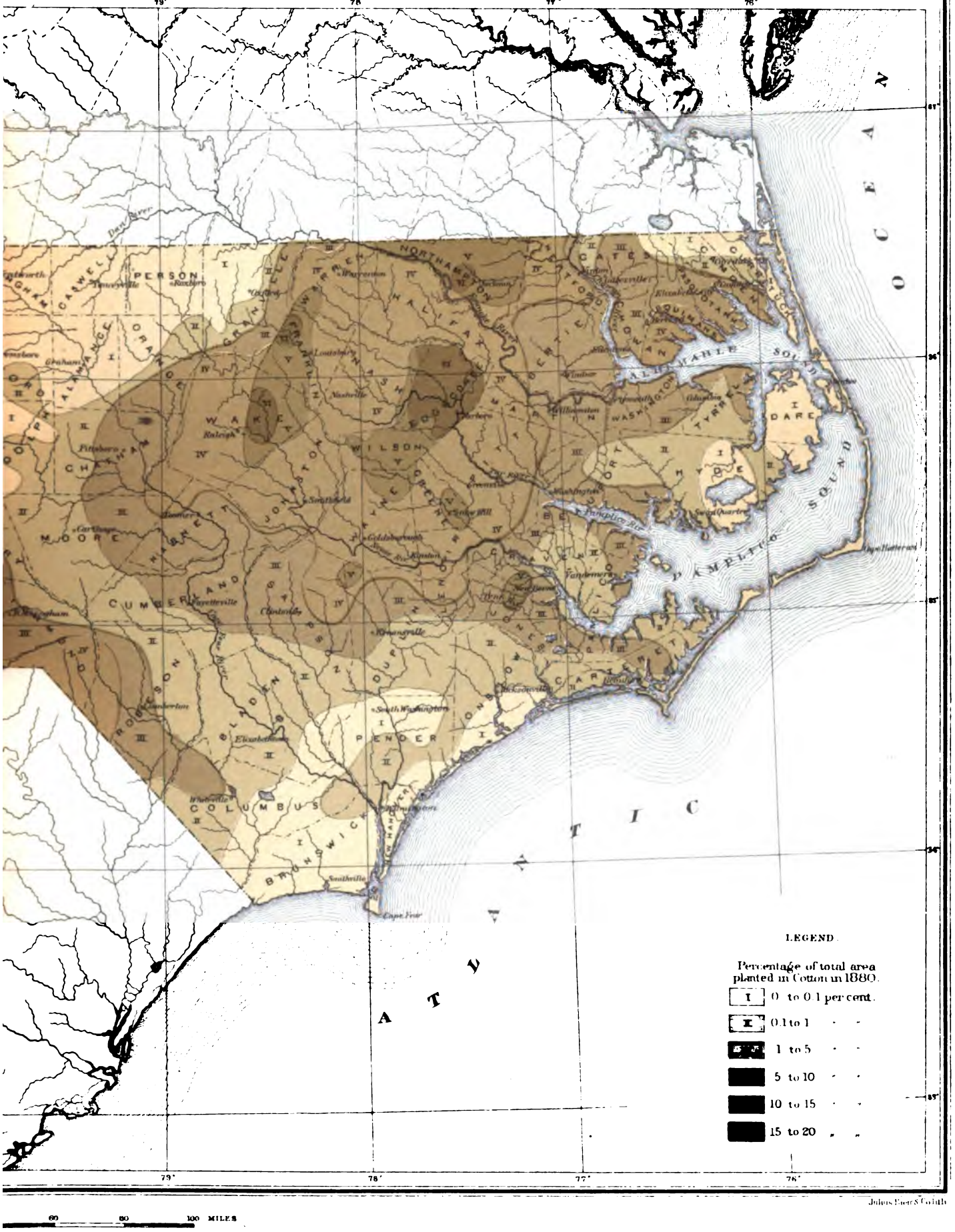
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ATLANTIC OCEAN
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GATES
CHOWAN
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PASQUOTANK
CAMDEN
CURRITUCK
ALBEMARLE SOUND
WASHINGTON
TYRRELL
DARE
HYDE
PAMPTICO SOUND
WAKE
WILSON
GREENE
LENOIR
JOHNSTON
CHATHAM
MOORE
RANDOLPH
CUMBERLAND
ROBESON
SAMPSON
DUPLIN
ONSLOW
JONES
CRAVEN
PITT
PENDER
BLADEN
COLUMBUS
BRUNSWICK
NEW HANOVER
Raleigh
Fayetteville
Wilmington
Newbern
Goldsboro
Kinston
Smithfield
Clinton
Warsaw
Elizabethtown
Whiteville
Southport
Cape Fear
Roanoke River
Pamptico River
Swash Quarter
Ocracoke
Cape Hatteras
LEGEND.
Percentage of total area planted in Cotton in 1880.
I 0 to 0·1 per cent.
II 0·1 to 1 " "
III 1 to 5 " "
IV 5 to 10 " "
V 10 to 15 " "
VI 15 to 20 " "
60 30 0 60 100 MILES
Julius Bien & Co lith

GENERAL REMARKS ON COTTON PRODUCTION IN NORTH CAROLINA.

Among the cotton states North Carolina is seventh in population, eighth in cotton production (389,598 bales), and eighth in bales per acre (0.44). The product in 1870 was 144,935, and in 1860 145,514 bales.

The following tables give various data relating to cotton production:

TABLE III.—SHOWING POPULATION AND COTTON PRODUCTION IN EACH AGRICULTURAL REGION OF THE STATE.

Agricultural regions.	POPULATION.			COTTON PRODUCTION.										
	Total.	White.	Colored.	Percentage of tilled lands devoted to cotton.	Acres.	Bales.	Average per acre.				Total in tons.		Percentage of state's total production in lint.	Average cotton acreage per square mile.
							Fraction of a bale.	Seed-cotton.	Lint.	Seed.	Lint.	Seed.		
								Lbs.	*Lbs.*	*Lbs.*				
Total	1,399,750	867,242	532,508	15.07	898,153	389,598	0.44	621	207	414	92,530	185,060	100	18.39
Seaboard region	193,268	102,275	90,993	13.34	85,557	36,554	0.43	609	203	406	8,682	17,364	9	9.6
Long-leaf pine region	407,643	200,977	206,666	25.84	466,367	209,475	0.45	639	213	426	49,750	99,500	54	32.4
Oak uplands	798,839	563,990	234,849	9.80	341,229	143,569	0.42	597	199	398	34,098	68,196	37	13.5

TABLE IV.—SHOWING "BANNER COUNTIES", AS REGARDS TOTAL PRODUCTION AND PRODUCT PER ACRE, IN EACH AGRICULTURAL REGION.

Regions according to product per acre.	Average product per acre of the region in bales.	COUNTIES HAVING HIGHEST TOTAL PRODUCTION.					COUNTIES HAVING HIGHEST PRODUCT PER ACRE.				
		Counties in each region having highest total production.	Rank in product per acre in the state.	Cotton acreage.	Total product in bales.	Product per acre in bales.	Counties in each region having highest product per acre.	Rank in total production in the state.	Cotton acreage.	Total production.	Product per acre in bales.	Rank in product per acre in the state.
Long-leaf pine region	0.45	Edgecombe	6	51,880	26,250	0.51	Wilson	9	23,706	18,049	0.55	3
Seaboard region	0.43	Beaufort	4	11,785	6,021	0.51	Brunswick	62	385	244	0.63	1
Oak uplands	0.42	Wake	7	59,916	30,115	0.50	Wake	1	59,916	30,115	0.50	7

In making estimates for this table all counties are excluded whose total production is less than 100 bales: County in the state having highest total cotton production: Wake, 30,115 bales; county in the state having highest product per acre: Brunswick, 0.63 bale, or 903 pounds of seed-cotton; county in the state having highest cotton acreage per square mile: Edgecombe, 91.50 acres.

COMPARISON OF THE AGRICULTURAL REGIONS.—It will be seen by an inspection of Table III that the long-leaf pine region is the cotton region of the state, producing 209,475 bales, or 54 per cent. of the total product, and also showing the largest product per acre, 0.45 of a bale (the average for the state being 0,44), the largest cotton acreage per square mile, 32 acres (that for the cotton region being 18 acres), and the largest cotton acreage per capita, 1.14 (the average being 0.64 acres). With an area of 14,401 square miles and 1,804,900 acres of tilled land, it has 26 per cent. of the latter in cotton.

Of the other two regions the oak uplands take precedence in acreage of cotton per square mile, 13.5 (to 9.6 in the other), and in total production, 143,569 bales, as against 36,554 bales for the seaboard region. The acreage per capita is about equal, 0.43 and 0.44 respectively, and in product per acre the latter has also slightly the advantage, 0.43 to 0.42.

The seaboard region has an area of 8,951 square miles, 641,580 acres of tilled land, of which a little over 13 per cent. is devoted to cotton. The oak uplands region has an area of 25,228 square miles, of which 3,479,607 acres are in cultivation, and a little less than 10 per cent. of the latter in cotton.

The precedence of the long-leaf pine region is still more apparent from some other points of view. Of the 22 counties, 16 produce more than 5,000 bales, 9 more than 10,000 bales, and the product of 3 exceeds 15,000 bales each. In the seaboard region there are only 2 counties whose product exceeds 5,000 bales; and in the oak uplands 8 counties produce more than 5,000 bales, 4 exceed 10,000 bales, and 2 pass 15,000 bales, and the average product per county in each region is respectively 21,000, 2,100, and 5,500 (including only the counties whose product exceeds 100) bales. But although the lead of the long leaf pine region in most respects is so decided, yet the county having the largest yield, and much the largest in the state (Wake), is found in the oak uplands region, producing 30,115 bales,

while the largest yield of a single county in the former region, that of Edgecombe, is 26,250 bales; and the county having the highest product per acre is found in the seaboard region, Brunswick, producing 0.63 of a bale, the highest product of the long-leaf pine region being 0.55 of a bale, in Wilson.

In the long-leaf pine region, and also the seaboard region, the white and colored population are nearly equal; and in the oak uplands, which produces 37 per cent. of the crops, the white population outnumbers the colored in the proportion of 2.4 to 1.

When the crops of the different regions for 1870 and 1880 are compared, several notable changes will be observed. While the total cotton product of the state has increased nearly threefold (2.7 to 1), the seaboard region has increased its product in nearly that average ratio (2.8 to 1), that of the long-leaf pine region has about doubled, and the oak uplands region has enlarged its product in the ratio of 4.5 to 1. If the subject be examined geographically, it will be found that in the latter region the cotton area has widened northward, taking into the zone of cotton culture an additional tier of counties, and toward the western part of the midland section and across the Piedmont as much as two tiers, making a breadth of fully 50 miles; so that a number of counties which in 1870 were not counted as cotton counties, their product being only a few score, or at most a few hundred bales, now produce as many thousand bales, as Granville, Stanley, Rowan, Iredell, Lincoln, Catawba, Cleaveland, and Rutherford. This remarkable result is due, in large part, to the introduction and general use of commercial fertilizers, which not only increase the crop, but hasten its maturity from two to three weeks, and so bring into the cotton belt a strip of plateau country whose elevation of from 800 to 1,200 feet had placed it just beyond the climatic range of the cotton-plant. This region, which in 1870 produced but little more in aggregate of bales than the yield of its banner county in 1880 (and much less than that in 1860), now produces as much as the whole state did at the last two enumerations. That this change is in no respect due to the altered relations of labor is obvious from several considerations, but sufficiently from this: that the product in 1860 and in 1870 was not only the same in total amount, but was distributed among the three regions in about the same proportions.

Fertilizers.—The use of commercial fertilizers is almost universal in the cotton counties, and composts of stable manure, cotton-seed, muck, woods-mold, and marl are also largely used in the best farming sections (the eastern regions), the first two being also used in the oak uplands. As has been already stated, the use of commercial fertilizers has increased very rapidly; indeed, has revolutionized the whole cotton industry of the state in the past decade, and the end is not reached. It will be seen that the crop of the long-leaf pine region was doubled in that time, and that of the other regions increased in a still larger ratio, and this not only through the increased acreage, but also an enlarged product per acre. An unfortunate result of the enlarged use of these manures is the diminished use of the marls, which abound in the eastern regions, and are accessible to almost every neighborhood. These marls are found in the ravines and the banks of streams and in the farm ditches in most of the eastern counties. Their value has been thoroughly tested on a hundred farms, and is admitted by all intelligent farmers to be very great. They increase the yield two and three fold, and are the most durable in their effect of all manures. A few analyses will sufficiently show the reason of their utility.

Analyses of marls of North Carolina.

[Made by E. H. Bogardus, chemist to New Jersey survey, and G. B. Hanna, United States assayer.]

	GLAUCONITIC (CRETACEOUS).			WHITE CHALK MARLS (EOCENE).				BLUE MARLS (MIOCENE).								
	Cape Fear river, Wilmington.	Neuse river, near Kinston.	Neuse river, 15 miles north of Kinston.	Wilmington.	Twenty-five miles north of Wilmington.	Neuse river.	Near New Berne.	Lumber river, Robeson county.	Cape Fear river, near Wilmington.	Cape Fear river, 25 miles north of Wilmington.	Middle part of Sampson county.	Near Kinston, Lenoir county.	Wilson county.	Near Weldon, Halifax county.	Tar river, Greenville.	Meherrin river, Murfreesboro', Hertford county.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Total	95.17	99.99	100.00	100.00	103.60	101.39	100.00	100.00	100.24	100.10	100.00	100.51	99.10	100.00	99.95	101.69
Insoluble matter	51.50	76.63	68.91	3.54	7.27	4.88	4.56	6.97	37.24	26.35	38.23	55.28	24.70	63.47	49.66	58.83
Potash	.....	0.51	0.62	1.28	1.06	1.37	Trace.	0.37	1.60	0.91	0.75	0.51	0.02	0.48	0.37	0.93
Soda	.....	0.11	.....	0.36	0.00	0.42	0.14	0.15	0.34	0.02	0.04	0.14	0.24	0.21	0.34	0.79
Lime	20.21	9.19	8.89	51.74	48.55	50.89	50.04	47.62	30.45	33.03	29.19	21.04	34.97	12.99	20.25	14.60
Magnesia	.....	0.30	1.20	0.50	1.39	0.67	1.72	1.03	1.88	0.59	0.58	0.23	2.26	2.87	0.37	0.41
Peroxide of iron, Alumina	7.59	4.23	9.91	0.97	5.23	1.60	1.62	0.86	2.09	5.47	5.15	2.92	6.01	4.18	4.99	3.62
Phosphoric acid	Trace.	0.73	0.24	0.35	0.10	0.45	0.34	0.19	0.38	1.67	1.40	0.43	0.32	0.38	3.75	0.18
Sulphuric acid	.....	1.83	4.21	0.49	0.20	0.33	0.45	0.41	1.10	0.28	1.57	1.96	1.08	0.61	2.02	2.82
Carbonic acid	15.87	6.00	5.76	40.61	39.35	40.60	40.55	38.15	25.16	24.89	21.41	16.40	29.06	12.68	11.72	10.23
Organic matter, Water	.....	0.46	0.26	0.16	0.45	0.27	0.58	4.25	.....	6.89	1.68	1.60	0.44	2.13	6.48	9.87

These marls belong to three classes: the first three are greensand, or Cretaceous: the next four, Eocene-Tertiary; the others, Miocene-Tertiary. No. 1 represents the greensand marl of the Cape Fear River section; the sample is from the river bluff at Wilmington. No. 2 is from a stream near Kinston, and represents that of the Neuse River section. No. 3 is from a point about 15 miles farther north, near the upper limit of the Cretaceous. These marls are not much used, because they contain too small percentages of lime and too large proportions of sand for sandy soils, and especially because so large quantities are required (500 bushels and upward to the acre), but they are used with very good results on clay soils.

The Eocene or chalk marls are very rich in lime, being, in fact, generally but uncompacted limestones or comminuted shells. Their content of potash and phosphoric acid is often of considerable value.

No. 4 is from Wilmington, where marls of this description are abundant and near the surface. No. 6, from near Kinston, represents the Eocene marls of the Neuse river; they extend from Goldsboro' to New Berne, and underlie the whole country to the Cape Fear. These are valuable fertilizers, and are used by the better class of farmers with very great advantage.

But the blue marls are more widely distributed than the others, and more accessible, and are much more extensively used. There are few counties of the long-leaf pine and seaboard regions in which these marls are not found. Forty or fifty years ago their introduction under the teaching of Mr. Edmund Ruffin, of Virginia, revolutionized the agriculture of Edgecombe and the adjoining counties. The marl is used in the compost heap or alone, and is distributed in the furrow or broadcast.

These samples fairly represent the marls and their distribution, and were taken from open pits which had been extensively used, in all cases with marked and permanent benefit. The marvel is they are not universally used, a hundred tons for every one.

Muck and peat beds are found in vast quantities in every section of the east, and these are also used in the compost heap, as are also marsh mud and sea-weed and fish and fish-scrap on the sea-coast and sound.

Analyses of soils and subsoils of North Carolina, made under the auspices of the Tenth Census.

Number.	Name.	Locality.	County.	Depth taken.	Vegetation.	Insoluble matter.	Soluble silica.	Total insoluble residue.	Potash.	Soda.	Lime.	Magnesia.	Brown oxide of manganese.	Peroxide of iron.	Alumina.	Phosphoric acid.	Sulphuric acid.	Water and organic matter.	Total.	Hygroscopic moisture at 400°.	Temperature of absorption, C.°	Analyst.
	OAK UPLANDS (METAMORPHIC).			*Inches.*																		
1	Gray gravelly loam	Near Raleigh	Wake	5	Pine, black, post, and white oaks, dogwood, and hickory.	87.209	3.142	90.342	0.101	0.023	0.060	0.023	0.074	2.780	3.094	0.056	0.095	3.140	99.788	2.592	17.0	J. B. Durrett.
2	Yellow subsoil	do	do	5–20		85.600	4.721	90.321	0.117	0.025	0.070	0.022	0.087	2.818	3.797	0.051	0.104	2.417	99.829	1.950	17.7	Do.
3	Dark-gray gravelly loam	do	do	6	Long-leaf pine, post, white, and black oaks, and hickory.	80.340	0.940	81.280	0.089	0.019	0.082	0.083	0.050	11.040	3.154	0.039	0.030	4.569	100.435	3.573	16.0	C. Cory.
4	Yellow-red clay subsoil	do	do	6–20		70.840	2.090	72.930	0.248	0.069	0.016	0.137	0.215	15.334	5.849	0.130	0.067	5.646	100.641	6.858	19.4	H. McCalley.
5	Light-gray gravelly loam	Spartanburgh, S.C.	Spartanburgh	6	Short-leaf pine, post, white, and black oaks, and hickory.	77.860	1.790	79.650	0.092	0.041	0.036	0.070	0.056	5.646	7.538	0.082	0.058	6.167	99.436	4.685	21.8	C. Cory.
6	Yellowish-brown subsoil	do	do	6–20		43.740	5.870	49.610	0.214	0.087	0.003	0.212	0.010	11.700	26.536	0.134	0.009	11.660	100.175	11.210	21.8	Do.
7	Gray gravelly loam	Charlotte	Mecklenburg	6	Black, white, red, and Spanish oaks, and hickory.	81.060	2.359	83.419	0.141	0.063	0.065	0.036	0.091	3.427	5.096	0.206	0.118	7.251	99.913	4.952	21.1	J. B. Durrett.
8	Red-brown clay loam subsoil	do	do	6–20		72.280	1.061	73.341	0.145	0.038	0.059	0.043	0.081	9.705	9.853	0.227	0.043	7.060	100.615	7.123	21.1	Do.
9	Gray gravelly clay loam	Near Concord	Cabarrus	7	White, black, and post oaks, and hickory.	78.786	7.405	86.191	0.131	0.012	0.335	0.311	0.052	4.967	4.024	0.136	0.075	3.876	100.130	3.346	21.8	H. McCalley.
10	Yellow subsoil	do	do	7–20		79.507	3.853	83.360	0.186	0.084	0.276	0.162	0.084	6.520	6.412	0.330	0.051	2.546	100.011	3.749	21.8	Do.
	LONG-LEAF PINE REGION.																					
11	Light-gray soil	Near Sparta	Edgecombe	3	Long-leaf pine, with small undergrowth of oaks and dogwood.	91.433	2.951	94.384	0.093	0.033	0.052	0.006	0.031	0.753	1.559	0.061	0.034	2.754	99.760	2.391	21.8	H. McCalley.
12	Yellow subsoil	do	do			91.842	3.514	95.356	0.087	0.029	0.019	0.025	0.029	1.766	1.563	0.101	0.040	1.175	100.190	2.190	21.8	Do.
	LEVEL PINE WOODS.																					
13	Gray sandy loam	Penny Hill	Pitt	11	Long-leaf pine, oaks, hickory, and dogwood.	77.735	4.016	81.751	0.204	0.109	0.177	0.073	0.091	4.786	7.398	0.143	0.154	5.760	100.646	6.710	20.5	J. B. Durrett.
14	Gray sandy loam subsoil	do	do			77.520	5.915	83.435	0.226	0.090	0.125	0.042	0.090	3.815	8.603	0.126	0.178	3.697	100.427	5.847	19.4	Do.
15	Gray sandy loam	5 miles north of Princeton.	Johnston	7	Long-leaf pine and wire-grass	94.810	1.283	96.093	0.085	0.037	0.045	0.030	0.101	0.368	1.314	0.071	0.048	2.406	100.598	1.876	25.5	Do.
16	Yellow subsoil	do	do	7–20		93.276	3.567	96.843	0.060	0.012	0.037	0.018	0.035	0.564	1.638	0.049	0.005	0.634	99.895	0.586	25.5	H. McCalley.
	UPLAND-LEVEL PINE WOODS.																					
17	Gray sandy loam	3 miles from Weldon.	Halifax		Short-leaf pine, oaks, little hickory, and dogwood.	91.500	1.580	93.080	0.135	0.047	0.123	0.048	0.111	1.580	2.900	0.117	0.040	1.678	99.859	2.344	29.0	J. B. Durrett.
18	Yellow subsoil	do	do			72.058	9.879	81.937	0.447	0.253	0.068	0.161	0.116	5.244	8.583	0.160	0.013	3.347	100.329	5.953	26.0	H. McCalley.
19	Gray sandy loam	Near Wilson C. H.	Wilson		Long-leaf pine and wire-grass	93.343	1.621	94.964	0.049	0.022	0.028	0.052	0.006	1.056	1.624	0.067	0.037	2.048	99.950	1.552	16.0	R. H. Loughridge.
20	Subsoil of "Lousin swamp"	7 miles north of Kinston.	Lenoir	15–20	Pine, sweet and black gum, and willow oak.	91.818	2.552	94.370	0.051	0.050	0.080	0.051	0.009	0.484	3.740	0.067	0.031	1.690	100.643	6.146	16.0	Do.

PART II.

AGRICULTURAL DESCRIPTIONS

OF THE

COUNTIES OF NORTH CAROLINA.

AGRICULTURAL DESCRIPTIONS

OF THE

COUNTIES OF NORTH CAROLINA.

The counties are here grouped under the heads of the several agricultural regions previously described to which each predominantly belongs, or, in some cases, under that to which it is popularly assigned. Each county is described as a whole.

The regional groups of counties are placed in the same order as that in which the regional descriptions themselves are given. The statements of areas of woodland, etc., refer to the original state of things, irrespective of tilled or otherwise improved lands.

Appended to the description of each county from which a report or reports have been received is an abstract of the main points of such reports, so far as they refer to natural features, production, and communication. Those portions of the reports referring to agricultural and commercial practice are placed in a separate division (Part III) following that of county descriptions. In making the abstracts of reports it has in most cases been necessary to change somewhat the language of the reporter, while preserving the sense.

SEABOARD REGION.

(Embraces the counties of Currituck, Camden, Pasquotank, Perquimans, Chowan, Dare, Tyrrell, Washington, Hyde, Beaufort, Pamlico, Craven, Carteret, Jones, Onslow, Pender, New Hanover, Brunswick, Columbus.)

CURRITUCK.

Population: 6,476.—White, 4,495; colored, 1,981.

Area: 282 square miles.—Woodland, 41,119 acres.

Tilled lands: 40,455 acres.—Area planted in cotton, 316 acres; in corn, 23,310 acres; in wheat, 101 acres; in oats, 267 acres.

Cotton production: 139 bales; average cotton product per acre, 0.44 bale, 627 pounds seed-cotton, or 209 pounds cotton lint.

Currituck county is bounded northward by Virginia, eastward by the Atlantic ocean, and southward mainly by Albemarle sound, and is traversed north and south by Currituck sound, which occupies about one-third of its territory. Between this sound and the Atlantic ocean lies a narrow strip of sandy soil, which in its origin is a sand-dune of the breadth of from 1 to 3 miles, rising in some of its higher hillocks to nearly one hundred feet, covered generally with a small growth of pine, oak, hickory, dogwood, etc. The body of the county, particularly the northern section, is quite level, and has a growth of oaks, hickory, and short-leaf pine and a clay loam soil, but becomes swampy near the streams. There is a narrow belt of oak and pine lands also in the middle section. The narrow southern promontory which projects into Albemarle sound is for the most part sandy, and except along the margin of the sounds, where it is more or less swampy, has a growth of long-leaf pine. With the exception of the dune hills, nearly the whole county lies below the level of 10 feet above tide.

The soils of this county are much better adapted to corn and rice than to cotton. The stalk of the latter grows luxuriantly, but does not fruit well. Fishing is also naturally a leading industry; and the county has great facilities for truck farming, which is rapidly acquiring importance. Of the county area, 22.41 per cent. is tilled land, of which 0.78 per cent. is cultivated in cotton.

The most abundant facilities exist for shipping by the sounds and canals and by rail.

CAMDEN.

Population: 6,274.—White, 3,791; colored, 2,483.
Area: 214 square miles.—Woodland, 65,729 acres.
Tilled lands: 35,870 acres.—Area planted in cotton, 2,670 acres; in corn, 23,663 acres; in wheat, 461 acres; in oats, 1,008 acres.
Cotton production: 823 bales; average cotton product per acre, 0.31 bale, 438 pounds seed-cotton, or 146 pounds cotton lint.

Camden county is a long narrow strip of territory parallel to Currituck. Northwestward it reaches the Dismal swamp and southward Albemarle sound, and lies between two of its projecting arms, Pasquotank river and North river. The northern and larger portion of this county belongs to the description of semi-swamp or oak flats, and along the main rivers, and frequently for a mile or two from their margins, are-gum and cypress swamps. At a distance from the streams these lands, as in the preceding county, are characterized by a heavy growth of oak, hickory, short-leaf pine, etc. The middle portion of the southern end of this county, along the divide between its two bounding water-courses, has a narrow zone of sandy loam soil with long-leaf pine forests. The main crops are corn and cotton, with some small grains; but fishing and truck-farming are also among the common and profitable industries, and several thousand bushels of flaxseed are annually exported. Of the county area, 26.20 per cent. is tilled land, of which 7.44 per cent. is cultivated in cotton.

Shipments are made to Norfolk by the Dismal Swamp canal and by rail.

PASQUOTANK.

Population: 10,369.—White, 4,855; colored, 5,514.
Area: 232 square miles.—Woodland, 44,345 acres.
Tilled lands: 51,400 acres.—Area planted in cotton, 4,004 acres; in corn, 28,525 acres; in wheat, 3,300 acres; in oats, 1,930 acres.
Cotton production: 1,181 bales; average cotton product per acre, 0.29 bale, 420 pounds seed-cotton, or 140 pounds cotton lint.

Pasquotank is a long, narrow strip of territory parallel to Camden county, and is of similar topographical situation and agricultural features. It is bordered eastward and westward by two bay-like arms of the sound, Pasquotank river and Little river, both of which take their rise in the Great Dismal swamp. The upper and middle portions, therefore, belong to the general description of swampy land and semi-swamps. Near the streams there are generally strips of swamp proper, with gum, cypress, and juniper forests, but farther from them are semi-swamps and oak and pine flats, with oak, hickory, short-leaf pine, ash, maple, black gum, and holly. These lands are of great fertility. The southern end of the peninsula on the sound is, as usual, sandy, piny woods. The industries of the county are the same as those of Camden. More cotton is produced, and lumbering still constitutes an item of consequence, as also in all these Albemarle counties. Truck farming is also assuming large proportions, and the raising of early potatoes for the northern market has recently become one of the most profitable industries. Of the county area, 34.62 per cent. is tilled land, of which 7.79 per cent. is cultivated in cotton. All these Albemarle counties have unlimited facilities of transportation through their numerous bays, rivers, and sounds, which are connected with Norfolk harbor through the Dismal swamp and the Currituck canals, and also by railway.

ABSTRACT OF THE REPORT OF C. W. HALLOWELL, OF ELIZABETH CITY.

There is a considerable variety of soil and a limited area of good cotton lands in scattered patches of from 20 to 300 acres, the lower lands being generally dark alluvial and wet, and not at all adapted to cotton. The higher lands, being drier, are better adapted to cotton. Only one year in several may be said to be a good cotton year. The early spring is apt to be cold and wet, which necessitates late planting; again, some of the moister soils will not mature the crops before the coming of early frosts. For these causes the "sure" cotton lands of this region are of very limited area. The soil may be divided, first, into the gray loam, with stiff foundation, and secondly into sandy ridges.

The chief soil is the *gray loam.* The proportion of the lands of the region of this kind does not exceed one-twentieth of the acreage, and its natural timber is beech, ash, white oak, poplar, sweet gum, and hickory. The average depth is 6 inches, when its color changes into that of the subsoil, which is a yellow sand mixed with clay. Near the water-courses the subsoil is yellow and sometimes bluish clay, and that of the dark lands is hard and crumbly. The chief crops are corn, wheat, cotton, oats, pease, potatoes, and flaxseed, but the soil is apparently best adapted to corn and flax. Three feet is the average height of the cotton-plant, which inclines to run to weed in wet summers. Topping has been tried, but without good effect. Fresh land produces in favorable seasons 1,000 pounds of seed-cotton per acre, and 1,425 pounds are needed for a 475-pound bale, which, when clean, rates in the market as middling and low middling. After seven years' cultivation the land produces 600 pounds of seed-cotton per acre. Crab- and water-grass are troublesome. The proportion of land originally cultivated now turned out is very small.

Cotton shipments are made, from October to January, by steamboats and sail vessels to Baltimore and Norfolk. Rates of freight per bale are 75 cents to Norfolk and $1 25 to Baltimore.

PERQUIMANS.

Population: 9,466.—White, 4,795; colored, 4,671.
Area: 245 square miles.—Woodland, 61,482 acres.
Tilled lands: 53,544 acres.—Area planted in cotton, 7,025 acres; in corn, 21,910 acres; in wheat, 2,957 acres; in oats, 1,222 acres.
Cotton production: 2,778 bales; average cotton product per acre, 0.40 bale, 564 pounds seed-cotton, or 188 pounds cotton lint.

Perquimans county is in every respect twin to the preceding, and northward it extends into the Great Dismal swamp. A considerable percentage of the surface of Perquimans is occupied by what is commonly called swamp land, though for the most part it is drainable and cultivable. These swamp lands, which are better described as semi-swamps and oak and pine flats, are a repetition of those before described, and have a similar soil, which varies from a fine gray loam to a dark mucky soil of high fertility. Along the Perquimans river, which is an arm of Albemarle sound, lie in a southeasterly drection narrow zones of cypress swamps, beyond which, northward and southward, are narrow tracts of sandy soil, with forests mainly of long-leaf pine. These long-leaf pine tracts, which occupy the divides between the streams, project in the form of promontories into the margin of the sound. Of the county area, 34.15 per cent. is tilled land, of which 13.12 per cent. is cultivated in cotton. Shipments are by sound and canal steamers and by rail to Norfolk.

ABSTRACT OF THE REPORT OF WILLIAM NIXON, OF WINFALL.

This county, divided nearly in half by the Perquimans river, has a sound front of fifteen miles, which is not subject to overflow, is level, and has different soils, principally clay, sandy, and black. Cotton is slow in getting off in the spring, and is liable to injury (shedding) from heavy rains in August.

About one-half of the county is what is designated *stiff land,* which extends 20 miles north and 15 miles east from the sound. The natural timber growth is sweet gum, oak, pine, poplar, ash, beech, hickory, holly, and dogwood. The land is a gray clay loam, about 6 inches deep; the subsoil is heaver than the surface soil, and is mixed with some very fine sand. Corn, cotton, wheat, oats, and potatoes are the chief crops. The soil is best adapted to corn and wheat, but one-fourth of the improved land is occupied by cotton. The plant is most productive when 3 feet high; but it grows from 2 to 5 feet in height, and is apt to run to weed in hot, wet weather. Fourteen hundred and twenty-five pounds of seed-cotton are required to make a 475-pound bale, rating in the market as middling. About 5 per cent. of the land originally cultivated now lies turned out, but does well when again cultivated.

The *sandy soil,* occupying about three-tenths of the land in this region, and extending from 8 to 10 miles north by 7 miles across the county, is timbered with pine, poplar, oak, and hickory. The soil is whitish yellow to the depth of 8 inches, when it changes into that of the subsoil, which is heavier than the surface soil, and is a clay mixed with sand. It is early, warm, and well drained, and is best adapted to corn, cotton, and sweet potatoes.

The *black soil* extends 10 miles north by from 2 to 4 miles east and west, and occupies about two-tenths of the lands. It is a blackish loam to the depth of 1 foot. The subsoil is clay and sand, underlaid with blue mud at the depth of 10 feet, and is best adapted to corn.

Cotton shipments are made, from November 1 to January 1, by steamboat to Norfolk and Baltimore. Rates of freight per bale are: to Norfolk, $1; to Baltimore, $1 50.

CHOWAN.

Population: 7,900.—White, 3,633; colored, 4,267.

Area: 150 square miles.—Woodland, 44,446 acres.

Tilled lands: 35,234 acres.—Area planted in cotton, 6,047 acres; in corn, 13,877 acres; in wheat, 622 acres; in oats, 791 acres.

Cotton production: 2,223 bales; average cotton product per acre, 0.37 bale, 525 pounds seed-cotton, or 175 pounds cotton lint.

Chowan county lies in the angle of the Chowan river and Albemarle sound. Northward it consists of sandy, upland piny woods, except narrow tracts along the river and some of its tributaries, where cypress swamps of considerable extent are found; and there are also large areas of oak flats. The southern portion of the county, lying near the sound and south of the Yeopim river, is characterized by a gray clay-loam soil and a mixed oak and pine forest growth, and is for the most part very productive. Bear swamp, which crosses the county in a northeast and southwest direction, is more properly a semi-swamp from 3 to 5 miles wide, very level, with a gray silty soil, and the characteristic growth of such lands comprises short-leaf pine, oaks, maple, ash, dogwood, occasionally cypress and gum, and frequently a large admixture of holly, which here attains the size of oaks and furnishes a superior cabinet wood. The agriculture of the county, as well as its other industries, is quite like that of Gates. Its fisheries are among the largest and most profitable in the country. Of the county area, 36.72 per cent. is tilled land, of which 17.16 per cent. is cultivated in cotton. Being surrounded on three sides by navigable waters and crossed by a line of railway, the county has abundant means of transportation.

ABSTRACT OF THE REPORT OF L. W. PARKER, OF SMALL'S CROSS-ROADS.

About one-half of the lands in this region is what is designated as *"Albemarle sound bank or level"*, about one-half being cultivated in cotton. This region is twenty miles in length and ten miles wide. Its natural timber is oak, gum, maple, and pine. The soil is black in the bottoms and a white sand on the hills, the average depth in the former being 2 feet. The subsoil is heavier than the surface soil, being in the bottoms a blue mud of a putty-like nature and on the hills yellow and sandy. Cotton, corn, potatoes, pease, and peanuts are the chief crops; but the soil seems best adapted to cotton, and 50 per cent. of the improved land is given to this crop, which is most productive when 3 feet high, and is inclined to run to weed in wet seasons when planted too deep, the remedy for which is manuring and good and early cultivation. In fresh land the seed-cotton product is 1,500 pounds per acre, of which 1,425 pounds make a 475-pound bale of lint, rating as middling staple. After five years' cultivation the product is 750 pounds per acre, and 1,540 pounds are needed to make a bale, the lint rating as low to middling. The carrot and hog-weed are most troublesome. About 25 per cent. of land once in cultivation now lies turned out, and when again taken in it produces finely for two or three years. It washes and gullies on the slopes, but the damage is not serious; but in most cases the valleys are improved by these washings of the uplands.

The *sandy ridge* occupies about one-third of the lands in this section, extends 20 miles in length by 6 miles in width, and is timbered with yellow pine. The soil is a white sand to the depth of 8 inches, with a subsoil of yellow sand heavier than the surface soil. It is early, warm, well-drained, and easy to till in dry seasons, and is apparently best adapted to wheat, pease, or cotton, and one-half is occupied by the latter crop. The cotton-plant attains the height of from 3 to 4 feet, but is most productive when 3 feet high. It is inclined to run to weed in wet seasons, and topping is practiced to stop this tendency. In fresh lands 1,425 pounds of seed-cotton is necessary for a 475-pound bale, which rates in the market as middling. After five years' cultivation the product ranges from 500 to 600 pounds per acre, and rates as low middling. Crab-grass is the most troublesome weed. About 10 per cent. of the land once in cultivation now lies turned out.

The *black swamps or bottoms* extend 10 miles square, and occupy one-fourth of the land in this region. The soil is a prairie, putty-like loam, black in color to the depth of 3 feet, when it changes into that of the subsoil, a blue mud, intermixed with some gravel. It is late, cold, ill-drained, and best adapted to corn and oats, but one-tenth of the improved land is occupied by cotton. The latter crop is most productive at the height of 3 feet, but grows from 4 to 8 feet high, and is inclined to run to weed under all circumstances. Fertilizing will favor bolling. The staple rates as low middling. The cost of production is about 6 cents per pound.

Cotton shipments are made as soon as ginned to Norfolk or Baltimore. Rates of freight per bale are: to Norfolk, $1; to Baltimore, $1 25.

DARE.

Population: 3,243.—White, 2,875; colored, 368.

Area: 382 square miles.—Woodland, 19,996 acres.

Tilled lands: 2,094 acres.—Area planted in cotton, 16 acres; in corn, 956 acres; in wheat, 25 acres; in oats, 17 acres.

Cotton production: 8 bales; average cotton product per acre, 0.50 bale, 714 pounds seed-cotton, or 238 pounds cotton lint.

The surface of Dare county is mainly water, the land, made up of a succession of long, narrow islands and peninsulas, being interpenetrated throughout by great bays, sounds, and navigable bayous. The county is bounded eastward by the Atlantic ocean, westward by Alligator river, and southward by Pamlico sound. The larger portion, on the mainland, is a swamp, which lies but a few feet above tide-level. Around the margins of this portion, next the sound, are narrow tracts of a few miles, in places, of drainable, cultivable land belonging to the general description of oak flats, having a gray-loam soil of a close texture. It is also fringed by considerable bodies of marsh land next the sound, from which large crops of cranberries are gathered. Roanoke island, a part of this county, lies within the upper portion of Pamlico sound, and is a narrow tract, twelve miles in length and from two to three miles in width. The upper portion is for the most part sandy, with a short-leaf pine growth, intermixed with oaks, and the southern half is mainly swamp and marsh. The easternmost part of the county, like the corresponding portion of Currituck, is a narrow fringe of sand reef, properly a dune, which, as in the former case, was originally covered with a forest of short-leaf pine, oaks, hickories, dogwood, etc., with abundance of grape-vines. These have for the most part disappeared, leaving a tract of sand waves, which are moving, under the impact of the trade winds, constantly toward the southwest into the sound, and sometimes rise to a height of more than 100 feet. There is very little tillable land in the county. Its chief industry is, of course, fishing. Of the county area, only 0.86 per cent. is tilled land, of which 7.63 per cent. is cultivated in cotton.

TYRRELL.

Population: 4,545.—White, 3,110; colored, 1,435.

Area: 376 square miles.—Woodland, 57,282 acres.

Tilled lands: 19,225 acres.—Area planted in cotton, 3,481 acres; in corn, 8,300 acres; in wheat, 261 acres; in oats, 781 acres.

Cotton production: 1,123 bales; average cotton product per acre, 0.32 bale, 459 pounds seed-cotton, or 153 pounds cotton lint.

The description of Tyrrell county may be given by simply repeating that of Washington, except that the great intersound swamp extends over a larger part of the county. Its northern third, lying on Albemarle sound, resembles in all its features the corresponding portion of Washington. No part of it rises 20 feet above sea-level. It is bounded on the east by the great projection from Albemarle sound known as Alligator river, which has a depth nearly equal to that of the sound and a breadth of from 3 to 5 miles. A portion of the rich border land of lake Phelps lies within this county. In the southeastern corner, along Alligator river and its tributaries, and on the western side, these lands are semi-swamps and oak flats, and have a gray silt and clay loam soil. Of the county area, 7.98 per cent. is tilled land, of which 18.11 per cent. is cultivated in cotton.

ABSTRACT OF THE REPORT OF EPH. LEIGH, OF FORT LANDING.

The uplands, or tillable lands of our creeks and rivers, are skirted by gum, cypress, and juniper swamps. The black or deep-soil lands are rather of a cold nature; hence cotton starts slowly in the early season, and when it does start it grows too rapidly and late, and consequently is cut off by frost. In our lighter lands the soil is warmer and the plant matures early, and so we have but very little stained cotton.

The chief soil is a *light, fine sandy loam* of a whitish-gray color, with a subsoil of tough yellow clay, very stiff, which in places looks nearly blue. Its natural timber is gum, poplar, ash, and pine. This soil is easy to till in good seasons, and is well-drained, early, and warm. Corn, cotton, wheat, oats, rice, and potatoes are the leading crops. The proportion of cotton planted is about one-third, and usually attains the height of from 2½ to 5 feet, about 3 feet being the most productive. Too much rain makes it run to weed, and topping will help to make it boll; 1,425 pounds is needed to make a bale. The most troublesome weeds are crab-grass and morning-glory. We are not troubled with gullies on the slopes.

The *black soil* forms about one-third of the lands, and is timbered with gum, poplar, cypress, ash, and oak. This soil is best adapted to rice, corn, pease, and potatoes. The proportion of cotton planted is probably one-tenth, 1,660 pounds of seed-cotton being necessary for a 475-pound bale.

Cotton shipments are made, from November to the middle of January, by steamboats and sailing vessels to Norfolk and Baltimore. Rates of freight are from 75 cents to $1 25 per bale.

WASHINGTON.

Population: 8,928.—White, 4,554; colored, 4,374.

Area: 382 square miles.—Woodland, 75,816 acres.

Tilled lands: 30,711 acres.—Area planted in cotton, 8,117 acres; in corn, 15,824 acres; in wheat, 647 acres; in oats, 1,065 acres.

Cotton production: 3,524 bales; average cotton product per acre, 0.43 bale, 618 pounds seed-cotton, or 206 pounds cotton lint.

Washington county lies on the southern shore of Albemarle sound and Roanoke river, and extends southward into the great intersound, or Alligator swamp. Only about one-half its territory, next to Albemarle sound, has been brought into cultivation to any extent, the southern half remaining in its original condition. The cultivable portion consists mainly of oak flats, having a close gray clay loam soil and a growth of oak, hickory, beech, maple, and short-leaf pine, with flattish ridges here and there which have an intermixture of long- and short-leaf pine and sandy loam soils. The former are generally quite fertile. The southern portion of the county is swampy, and is characterized by the presence of two considerable lakes, Phelps and Pungo, which occupy the highest portions of the swamp, and from which many of the streams of the county take their rise. Around the margins of these lakes are narrow belts or ridges of swampy, mucky land, which were originally covered by heavy forests of gum, ash, maple, cypress, poplar, etc. The soils are of great depth and indefinite fertility. Much of the swamp land of this portion of the county is peaty and worthless, except for timber. The southwestern section consists partly of semi-swamps, with gray fertile loams, and partly, in the "Longacre" country, of *pocosons*, with a small growth of pine and scrub oaks, very flat, with an ashen soil of close texture, siliceous, but as impervious as clay. Of the county area, 12.56 per cent. is tilled land, of which 26.43 per cent. is cultivated in cotton.

ABSTRACT OF THE REPORT OF J. P. NEWBERRY, OF PLYMOUTH.

Cotton in the lowlands is invariably late, and is apt to grow too much weed. The high and sandy soil is preferred. The soils cultivated in cotton are: first, the light and sandy; second, the dark clay, the chief soil, the *light and sandy*, occupying five-eighths of the lands in this region. Its natural timber is cypress, pine, gum, ash, and poplar. The average thickness of the upland soil is 3 inches; of the lowland, 18 inches. The subsoil is heavier, and is described as a clay and gravel mixed, underlaid by sand and gravel at 8 feet, which is rather difficult of tillage in wet seasons. Cotton, corn, and potatoes form the principal crops. The soil is best adapted to cotton on the upland and corn on the lowland. The proportion of cotton planted is one-half, which is most productive at the height of 2½ feet. On rich soils in wet seasons it is inclined to run to weed, but topping in July and August help to prevent it. Fresh land produces from 1,000 to 1,200 pounds of seed-cotton per acre, 1,425 pounds being needed for a 475-pound bale, which, when clean, rates in the market as good middling. After five years' cultivation the yield is from 500 to 600 pounds per acre, and 1,425 pounds is then needed to make a bale, but it does not rate as well in the market. Crab-grass is the most troublesome weed. The slopes are but little subject to gullies.

Cotton shipments are made in November and December by steamboat to Norfolk and Baltimore. Rates per bale are $1 25 and $1 40.

HYDE.

Population: 7,765.—White, 4,424; colored, 3,341.

Area: 557 square miles.—Woodland, 41,247 acres.

Tilled lands: 32,167 acres.—Area planted in cotton, 2,513 acres; in corn, 21,632 acres; in wheat, 1,079 acres; in oats, 1,354 acres.

Cotton production: 718 bales; average cotton product per acre, 0.29 bale, 408 pounds seed-cotton, or 136 pounds cotton lint.

Hyde county is enveloped by sounds and great bay-like rivers, and its middle portion is occupied by a large lake, Mattamuskeet, 20 miles in length and 6 miles wide, with two other lakes in its northern portion. Two-thirds of its land-surface is occupied by the great Alligator swamp. A narrow fringe of from 1 to 2 miles' width around the central lake is the highest portion of the county, and is from 6 to 10 feet above tide. It was originally covered with a heavy swamp growth of cypress, gum (tupelo), maple, ash, etc. These lands have been cultivated for a century, and still produce 50 bushels of corn to the acre without manure or rotation. This ridge slopes off in every direction from the lake—eastward into a tract of oak flats, which extends to the sound. The southwestern portion of the county within the projecting arms of Pungo river and other bays from Pamlico sound may also be described as oak flats, with a soil which, in general terms, is a gray silty loam—an admirable wheat soil. The northern portion of this county, throughout its whole extent from east to west, is a low-lying savanna or peaty cypress and juniper swamp, like the Great Dismal, called Alligator swamp. Of the county area, 9.02 per cent. is tilled land, of which 7.81 per cent. is cultivated in cotton. The productions of this county are chiefly corn and wheat, to which has been recently added rice. Lumbering and fishing complete the list of its industries.

BEAUFORT.

Population: 17,474.—White, 10,022; colored, 7,452.

Area: 620 square miles.—Woodland, 224,330 acres.

Tilled lands: 43,625 acres.—Area planted in cotton, 11,785 acres; in corn, 20,225 acres; in wheat, 374 acres; in oats, 1,395 acres.

Cotton production: 6,021 bales; average cotton product per acre, 0.51 bale, 729 pounds seed-cotton, or 243 pounds cotton lint.

Beaufort county lies south of Washington county on both sides of the Pamlico river, which in this part of its course is an arm of the sound of the same name, from 2 to 6 miles wide, and throws off several wide projections or bays into the county on both sides. It is bounded on the east by Pungo river, another broad arm of Pamlico sound, whose waters also penetrate the county in numerous wide navigable bayous. A considerable proportion of the county is occupied by swamp lands. In the northern section, and across its whole breadth, lies the western extremity of the great intersound swamp, which attains its greatest elevation here of 40 feet above tide. In this culminating swell between the Roanoke and Pamlico rivers rise numerous tributaries of these rivers and of the sounds. The central portion of this part of the swamp belongs to that class of soils described as "pocoson", and is of very low fertility. Along the courses of the streams as they flow out from this swell are considerable marginal tracts of semi-swamp and oak flats, which are very productive. There are also belts of cypress swamp near Pamlico

river and the other streams on both sides, and south of the swamp, in the middle as well as along the western edge of the county, the land is mostly a level piny woods with a light sandy soil. In the eastern portion of the county, and on both sides of the Pamlico river, both along the banks of this river and of the before-mentioned projections, are large tracts of oak flats and semi-swamp, which are among the most productive soils of the region. Near the mouth of Pungo river occurs one of the largest prairies or natural meadows, *savannas*, in the state, embracing an area of 1,200 or 1,500 acres. It is treeless and fringed by short-leaf pine and oak forests, and has a fine, close, gray sandy soil, as impervious as clay. Its subsoil is of the same character, but is more clayey, and is of a slightly yellowish color. Marl is found in various parts of the county, but is little used. Of the county area, 10.99 per cent. is tilled land, of which 27.01 per cent. is cultivated in cotton.

ABSTRACT OF THE REPORT OF R. W. WHARTON, OF WASHINGTON.

Sandy loams and clay soils are in about equal proportions, and near the rivers are thin sandy loams and clays. All are good for cotton, but loams are preferred. On heavy black bottom lands, as also on heavy clay upland, cotton is liable to be prematurely frost-killed.

The *sandy loam* is the chief soil, and occupies one-half of the lands in this region. Its natural timber on the uplands is pine, intermixed with oak; on the bottoms the growth is gum, cypress, ash, and poplar. The average thickness of the soil is 2 feet on the bottoms and 1 foot on the uplands. The subsoil is heavier, and is usually yellow or grayish under the loam or clay soil and a coarse yellow sand under the sandy soil. Cotton, corn, oats, wheat, sweet and Irish potatoes, peanuts, and field pease are the chief crops. The soil is well adapted to all the above crops except wheat, which requires heavy manuring. The proportion of land planted in cotton is one-third, which is most productive when 3½ feet high. It inclines to run to weed on rich lands if the seasons are very warm and wet, for which early planting and the use of phosphatic manures are beneficial. Fresh land produces from 900 to 1,000 pounds of seed-cotton per acre, 1,425 pounds ordinarily making a 475-pound bale, which, when clean, rates in the market as low middling and middling; but much depends on ginning and handling. After six years' cultivation the land will produce 600 pounds per acre if proper rotation is observed, otherwise from 300 to 400 pounds, from 1,485 to 1,540 pounds being needed to make a bale, which rates two grades lower than staple from fresh land. Crab-grass and fennel are the most troublesome weeds. One-twentieth of this land now lies turned out, but when again taken in it produces for two or three years as well as original soil. The soil readily washes or gullies on the slopes, but no great damage is done, and efforts have been made, with good success, to check it by horizontalizing.

Shipments are made, from the 20th of September to the 1st of February, by steamers to Norfolk, Baltimore, Philadelphia, and New York. Rates of freight are: to Norfolk, $1; to New York, $2 per bale.

PAMLICO.

Population: 6,323.—White, 4,207; colored, 2,116.
Area: 470 square miles.—Woodland, 86,574 acres.
Tilled lands: 16,989 acres.—Area planted in cotton, 4,585 acres; in corn, 6,381 acres; in wheat, 285 acres; in oats, 378 acres.
Cotton production: 2,226 bales; average cotton product per acre, 0.49 bale, 693 pounds seed-cotton, or 231 pounds cotton lint.

Pamlico county is bounded on the east by Pamlico sound, and is enveloped by two of its great arms, Pamlico and Neuse rivers. Another of these arms, Bay river, with its numerous bayous, penetrates the central portion of the county, and nearly its whole border is deeply indented by smaller projections from the sound. A large part of the county consists of swamp lands with extensive oak and beech flats. These soils are very rich. Cotton is a leading crop in this county. There is a narrow belt of sandy, piny woods crossing the county diagonally from the southeastern angle at Wilkinson's point to Durham's creek in the northwestern corner. Of the county area, only 5.65 per cent. is tilled land, of which 25.20 per cent. is cultivated in cotton.

ABSTRACT OF THE REPORT OF J. S. LANE, OF STONEWALL.

All our lands are low and mostly bottoms. The chief soil is the *stiff or clay land*, which forms one-third of the lands, and extends at intervals over the whole county. Its natural timber is pine, cypress, juniper, cedar, poplar, maple, ash, oak, holly, and black and sweet gum. The soil is grayish in color to the depth of from 6 to 12 inches. The subsoil is considerably more compact than the surface soil, and is impervious to water. We have surface drains on all our stiff lands. The chief crops are cotton, corn, rice, sweet and Irish potatoes, wheat, and oats, and the soil is well adapted to all. Cotton occupies about two-fifths of the cleared land and usually attains a height of from 3 to 5 feet, but is most productive at 3 or 4 feet; it inclines to run to weed when we have morning rains about fruiting time, which causes the fruit to drop and the stalk to continue to grow. Fresh land produces from 1,500 to 2,000 pounds of seed-cotton per acre, and 1,485 pounds will make a 475-pound bale, which rates in the market as good ordinary to low middling. After eight years' cultivation the yield is 1,000 pounds, and 1,485 pounds are needed to make a bale, the grade being about the same as that from fresh land. The most troublesome weeds are rag-weed, dog-fennel, and Spanish needle. No land now lies turned out, and it is not subject to wash, as our land is level.

About one-half of the lands in this region are the *black alluvial soils*, which extend throughout a large portion of the adjoining counties, and are timbered with oak, ash, pine, poplar, beech, maple, holly, elm, juniper, and cypress. This soil produces well while fresh, but becomes worthless for cotton by long cultivation unless well marled or limed. The cost of cotton production is 10 cents per pound.

Cotton shipments are made, from October to March, to Norfolk, New Berne, and Baltimore. Rates of freight per bale are: to Norfolk, $1 50; to New Berne, 50 cents.

CRAVEN.

Population: 19,729.—White, 6,664; colored, 13,065.
Area: 820 square miles.—Woodland, 197,135 acres.
Tilled lands: 50,853 acres.—Area planted in cotton, 12,838 acres; in corn, 19,001 acres; in wheat, 235 acres; in oats, 333 acres.

Cotton production: 5,782 bales; average cotton product per acre, 0.45 bale, 642 pounds seed-cotton, or 214 pounds cotton lint.

Craven is a large, straggling county, stretching 60 miles along the lower reaches of the Neuse river, which passes through its center and drains its entire area. The physical description of its territory, especially the southern and eastern sections, is identical with that of the two preceding counties. It consists largely of swamps, pocoson, and oak flats. The section lying north of the Neuse river belongs for the most part in its agricultural features to the second subdivision, or long-leaf pine belt, having considerable tracts of pine flats and long-leaf pine ridges, with a soil often very sandy and unproductive. Near its upper margin it is penetrated by considerable tracts of swamp and semi-swamp lands, which project southward from Pamlico river and form properly the western extension of Bay River swamp. Along the southern shore of Neuse river the soil is mainly a close gray loam. The great Dover pocoson, occupying more than 100 square miles in its southwestern angle, is elevated 60 feet above tide in its central part, and is very flat and sterile for the most part, but has strips of oak and pine flats radiating in all directions from the center along the numerous streams. Of the county area, 9.68 per cent. is tilled land, of which 25.25 per cent. is cultivated in cotton.

ABSTRACT OF THE REPORTS OF CHARLES DUFFY, JR., AND JOHN HUMPHREY, OF NEW BERNE.

There is not a great deal of rolling land in this vicinity, and the kinds of soil cultivated in cotton are: brown lands, with fine clay subsoils; lowlands of the great swamp; and last, the light sandy soil on the banks of the Neuse river.

The *brown uplands* are the best for cotton, and a large proportion of the region is of this kind. The soil is timbered with pine, gum, holly, hickory, and dogwood, and its thickness is from 3 to 6 inches. The subsoil is heavier, and is usually a clay, underlaid at a depth of from 6 to 20 feet with shell marl, and in some places by hard-pan, which is leachy and impervious to water. Cotton, corn, oats, rye, pease, and potatoes are the leading crops, but the soil seems best adapted to corn and cotton, and the latter occupies probably 20 per cent. of the cultivated land. Cotton attains the height of from 18 to 36 inches, but inclines to run to weed in wet seasons, to prevent which we use marling and thorough draining. The yield is from 1,000 to 1,500 pounds of seed-cotton per acre, from 1,425 to 1,540 pounds being required for a 475-pound bale, which, when clean, rates as middling to good middling. After ten years' successive cultivation the yield is from 300 to 500 pounds per acre, and then from 1,485 to 1,600 pounds is needed to make a bale, which rates a grade or two lower than that from fresh land. The most troublesome weeds are dog-fennel, hog- and carrot-weed. About 10 per cent. of the land originally cultivated now lies turned out, but when taken in cultivation again it does admirably. Some damage is done by gullies and washes on slopes.

The *swamp land* occupies about 10 per cent. of the lands in this region. Its natural timber is gums, cypress, oak, poplar, and large pines (short-leaf). The average thickness of the soil is from 1 to 3 feet, when it changes into subsoil, which is heavier than the soil, and is usually a clay resting on sand and pebbles, and then on marl or rock. The soil is early and warm when well drained, and is apparently best adapted to corn, but makes good cotton. The proportion of cotton planted is 5 per cent, which usually attains and is most productive at the height of 3 feet. Fresh land produces from 1,000 to 2,000 pounds of seed-cotton per acre, 1,425 pounds being needed for a 475-pound bale, which rates the same in the market as that from the brown uplands. It produces after ten years' cultivation from 1,000 to 1,500 pounds per acre, 1,425 pounds being required to make a bale. The staple is usually better than that from fresh land. The soil is but little subject to gullies; no damage is done.

The *light sandy soil* also occupies about 10 per cent. of the lands in this region, and has a growth of oak, hickory, pine, and dogwood. The color is a whitish gray to the depth of 6 inches, when it changes to that of the subsoil, which is a yellow sand and clay, never difficult to till. This soil is admirably adapted to truck-farming, and with proper fertilizers many early vegetables of the finest quality can be produced. Cotton inclines to run to weed on this soil in very dry seasons. The staple from the fresh land rates, when clean, as middling.

Shipments are made, from October 1 to January 1, by steamboat to Norfolk, New York, and Boston. Rates of freight per bale are $2 and $3.

CARTERET.

Population: 9,784.—White, 7,107; colored, 2,677.

Area: 407 square miles.—Woodland, 67,211 acres.

Tilled lands: 17,984 acres.—Area planted in cotton, 2,936 acres; in corn, 5,156 acres; in wheat, 418 acres; in oats, 107 acres.

Cotton production: 1,014 bales; average cotton product per acre, 0.35 bale, 492 pounds seed-cotton, or 164 pounds cotton lint.

Carteret county occupies a long strip of country south of Craven county and of Pamlico sound, and is bounded southward by the Atlantic ocean. It is traversed east and west through the middle by a succession of swamps, the largest of which, occupying its eastern peninsular projection, is called the Open Ground Prairie swamp. This is a peat swamp, quite barren in its middle parts, but fringed around its margin with oak flats and gray silty soil. There is also a line of sand islands (sand dunes) along the coast, and inland, parallel to the coast, are several ridges of long leaf pine sandy lands. The highest part of the county is only 37 feet above tide. Carteret has the advantage of the best harbor on the coast of this state. Of the county area, 6.90 per cent. is tilled land, of which 16.33 per cent. is cultivated in cotton.

ABSTRACT OF THE REPORT OF A. OAKSMITH, OF HOLLYWOOD (J. H. BECTON ALSO FURNISHED A REPORT).

The soils on ridges, as also on the high banks bordering on Bogue sound, we term the uplands. In seasons of drought our lowland cotton lands do the best; in ordinary seasons, upon an average, the uplands are most reliable.

The chief soil cultivated in cotton is a *light sandy loam*, which occupies the larger portion of the lands in this region, embracing all the uplands, plains, and ridges, and is timbered mostly with the different varieties of pine, with some oak. The soil is a fine and coarse sandy loam of a mixed gray, buff, and brown color to the depth of 20 inches, when it changes into that of the subsoil, which is heavier than the soil, and varies at different places, being in some places a strong bluish clay, in others a species of marl and a black peculiar rocky substance.

The chief crops are cotton, corn, rye, oats, wheat, sorghum, Irish and sweet potatoes, and truck, but the soil is apparently best adapted to cotton, corn, sorghum, and sweet potatoes. Cotton attains the average height of 3 feet, and runs to weed in wet weather. Fresh land produces about 800 pounds of seed-cotton per acre, about 1,425 pounds making a 475-pound bale, which rates as middling when clean. After two years' cultivation the product is from 600 to 700 pounds per acre, about 1,540 pounds being needed to make a bale, the staple rating as low middling. Jerusalem oak and dog-fennel are the most troublesome weeds. About one-third of land once cultivated now lies turned out.

The *bottom lands* of Newport river are black prairie, with a darker heavy sandy loam soil.

In the *lowlands* are alluvial deposits and black swamp lands. Very little cotton is planted on these last two soils.

Cotton shipments are made in November by rail to New Berne at 75 cents per bale.

JONES.

Population: 7,491.—White, 3,212; colored, 4,279.

Area: 389 square miles.—Woodland, 134,598 acres.

Tilled land: 53,458 acres.—Area planted in cotton, 8,463 acres; in corn, 19,425 acres; in wheat, 429 acres; in rye, 245 acres; in oats, 455 acres.

Cotton production: 4,078 bales; average cotton product per acre, 0.48 bale, 687 pounds seed-cotton, or 229 pounds cotton lint.

The great tract of swamp land which lies between the Neuse river and the Atlantic ocean and extends through a considerable portion of the two preceding counties projects westward into Jones county, where it reaches its highest elevation of 40 feet, and is crowned by a chain of small lakes of from 1 to 3 or 4 miles diameter on the summit, on the border of Jones and Carteret counties. The northern border of the county is occupied by a portion of the great Dover pocoson, which projects into it from Craven. In its middle and southern sections lies a great part of the great White Oak swamp, the central portion of which is also a pocoson; but it is margined about with fringes of canebrake lands, white-oak flats, and cranberry marshes, as well as by considerable tracts of swamp lands covered with oak, cypress, gum, poplar, ash, etc. Trent river flows through the center and, with its tributaries, drains almost its entire area. Along this river on both sides are considerable bodies of long-leaf pine sandy lands. There are also along the main river, as well as its tributaries, narrow strips of oak flats and occasional gum and cypress swamps. The county resembles, therefore, very closely the two last described in physical features and in products and industries. Of the county area, 21.47 per cent. is tilled land, of which 15.83 per cent. is cultivated in cotton.

ABSTRACT OF THE REPORT OF H. C. FOSCUE, OF POLLOCKSVILLE.

On the Trent river, for a mile on each side, there is a level tract of land with a light soil; then we have a gray land with stiff clay subsoil. The stiff soils are most generally used for cotton, but fair crops are made on the light soil. Our best is the *light soil* having a clay subsoil. This soil is more easily drained and cultivated, and the cotton matures better, and makes the best yield. It occupies about one-eighth of the land in this region, and is found in a belt along the Trent river between the very light lands and those with very heavy clay subsoils. The timber is oak, hickory, poplar, and dogwood. The average thickness of the soil before its color changes into that of the subsoil is from 6 to 18 inches. The subsoil is clay, but not close pipe-clay. Cotton is the market crop, nearly all other crops being raised for home consumption, but corn is perhaps best adapted to the soil. The proportion of cotton planted is one-third. It is most productive at the height of 3 feet, and is inclined to run to weed when planted late or in ill-drained land; but efforts are made to restrain this by draining and the use of lime. Fresh land produces 700 pounds of seed-cotton per acre, 1,425 pounds being needed for a 475-pound bale, which, when clean, rates in the market as middling. After five years' cultivation it produces about 300 pounds per acre, and from 1,485 to 1,540 pounds are needed for a 475-pound bale. The lint is much shorter and not so strong as that from fresh land. Hog-weed is the most troublesome weed. The proportion of land once cultivated now lying out is very small; it washes and gullies on the slopes, but the damage is not great. The valleys are injured by the washings to a small extent, and efforts have been made to check it by horizontalizing with good success.

The *stiff land*, of which two-thirds is planted in cotton, extends from 5 to 10 miles back from the river, and is timbered with pine and has an undergrowth of gallberry. The soil is best adapted to cotton, and is a gray clay loam to the depth of from 1 to 2 feet. Cotton occupies two-thirds of the land that is cleared. The stalk grows to the height of 4 feet, but is most productive at 3 feet. In wet seasons, and when planted late, the cotton inclines to run to weed, but by drainage and lime this tendency can be checked. The land, when fresh, will yield from 500 to 700 pounds of seed-cotton per acre, 1,425 pounds making a 475-pound bale. This staple rates in the market as middling when clean. After five years' cultivation the soil yields 300 pounds per acre, and then 1,485 pounds make a bale. The staple is much shorter than that from fresh land. About one-tenth of this land once cultivated now lies turned out, and when taken into cultivation again it does not do so well for the first year, as it is then sour.

Cotton is shipped to New Berne. Rates of freight per bale are from 40 to 75 cents.

ONSLOW.

Population: 9,829.—White, 6,600; colored, 3,229.

Area: 645 square miles.—Woodland, 212,866 acres.

Tilled lands: 56,120 acres.—Area planted in cotton, 6,658 acres; in corn, 23,259 acres; in oats, 96 acres.

Cotton production: 2,841 bales; average cotton product per acre, 0.43 bale, 609 pounds seed-cotton, or 203 pounds cotton lint.

The identical terms used in the description of the preceding county might be repeated for Onslow. Nearly one-half of the White Oak swamp lies in its northern section, and from it flow most of the streams by which the county is drained. The best agricultural lands of the county lie along the margin of this swamp. A great part of it is drained southward into New river, which traverses the entire length of the county from north to south. This river for one-half of its length is a broad, navigable bay, from 1 to 2 miles wide, and is famous for its fine oysters and fish. On both sides of it are large tracts of upland piny woods, with a gray sandy soil, which are admirably adapted to the

production of cotton. Nearer the sea-coast and its fringe of sounds the soils are more sandy, and are covered with long-leaf pines as their principal growth, a similar large tract occupying its northwestern section. There are numerous narrow fringes of cypress swamps along the various streams. A portion of the southwestern side of this county is penetrated by the Holly Shelter pocoson. The productions of this county are similar to those of the preceding. Of the county area, 13.59 per cent. is tilled land, of which 11.86 per cent. is cultivated in cotton.

Shipping is done by way of New river, which is navigable to the middle of the county.

PENDER.

Population: 12,468.—White, 5,509; colored, 6,959.

Area: 889 square miles.—Woodland, 287,700 acres.

Tilled lands: 38,156 acres.—Area planted in cotton, 1,463 acres; in corn, 16,550 acres; in wheat, 7 acres; in oats, 183 acres.

Cotton production: 835 bales; average cotton product per acre, 0.57 bale, 813 pounds seed-cotton, or 271 pounds cotton lint.

Pender county, like the preceding, is bounded in part on the south by the Atlantic ocean, with its fringe of sounds, marshes, and dunes, and is drained southward by the waters of the Northeast Cape Fear river. Holly Shelter pocoson occupies a large part of the southeastern section, and from it flow numerous creeks into the above-mentioned river, while others flow directly into the Atlantic. The central portion and larger part of this great pocoson, which contains about 100 square miles, is quite barren, but around its margin, especially toward the river, are considerable tracts of white-oak flats, canebrake, and swamp lands, with their characteristic growths and soils. In the northeastern section lies the half of another similar pocoson nearly as large, called Angola bay, and in the center of the western half of the county is a third but much smaller swamp of the same general character. The western side of the county for the breadth of from 6 to 8 miles belongs to the region of upland piny woods, the principal growth being long-leaf pines, with an undergrowth of oaks, hickory, dogwood, etc., and a sandy soil; but some of it approaches the character of the regular "sand-hills", with pine and oak flats here and there. Along the streams are generally alluvial belts or swamps and oak flats, which are the corn lands of the county. A savanna of several square miles is found in the upper end of the county, which merges northward into a barren pocoson of still greater extent. Marl abounds in all parts of the county, and Eocene limestone is found along the principal river above named. These add greatly to its agricultural advantages.

The cotton product is inconsiderable; the remaining products are corn, rice, potatoes, lumber, and naval stores.

Of the county area, 6.71 per cent. is tilled land, of which 3.83 per cent. is cultivated in cotton.

Cotton and other products are shipped to Wilmington and Norfolk by rail, or to the former by the two Cape Fear rivers, which form the boundaries east and west.

NEW HANOVER.

Population: 21,376.—White, 8,159; colored, 13,217.

Area: 182 square miles.—Woodland, 39,603 acres.

Tilled lands: 7,396 acres.—Area planted in cotton, 142 acres; in corn, 2,008 acres; in oats, 86 acres.

Cotton production: 66 bales; average cotton product per acre, 0.46 bale, 663 pounds seed-cotton, or 221 pounds cotton lint.

New Hanover is one of the smallest counties in the state, and consists of a narrow triangular wedge between the Cape Fear river on the west and the Atlantic coast on the east, with its narrow fringe of sounds, marshes, and dunes. The margins of the streams and sounds are bordered in many places by narrow strips of oak and pine flats with a gray silty soil. The central portion of the county, as well as the dunes along the shore, are sandy and unproductive; but there are tracts of alluvial and swamp-land river bottoms along the Cape Fear which produce large crops of rice. The county contains the largest city in the state, Wilmington (population nearly 20,000). It is also the most important seaport, and has a large foreign as well as inland trade in lumber, naval stores, and cotton, both by means of its railways and navigable rivers. Of the county area, 6.35 per cent. is tilled land, of which 1.92 per cent. is cultivated in cotton.

ABSTRACT OF THE REPORT OF A. R. BLACK, OF WILMINGTON.

Cypress swamps are not, but sand flats (pocosons) are, very extensive in this county. Very good alluvial lands are to be found on both branches of the Cape Fear river, and sandy loams abound near these rivers and along the coast. The kinds of soils cultivated in cotton are *pine, oak, and hickory flats*, with clay subsoils which are inclined to be stiff. The proportion of the lands in the region of this kind is very small, not exceeding 3 per cent. The cotton lands are generally found near the streams and interspersed along the coast, and are timbered principally with long-leaf pine, with some short-leaf pine, hickory, dogwood, red oak, chincapin, and sweet gum. The average thickness of the soil is from 4 to 6 inches, with a subsoil of clay, mixed more or less with sand, under cotton lands. The chief crops are peanuts, corn, rice, sweet and Irish potatoes, and garden truck, but the soil is best adapted to peanuts and rice. The proportion of cotton planted is not one acre in one hundred. The height usually attained by the cotton-plant is 3 feet, and it is most productive at that height. It inclines to run to weed when planted in swamp lands, but guano or manure favors bolling. Fresh land produces from 500 to 1,000 pounds of seed-cotton per acre, about 1,540 pounds making a 475-pound bale, the staple rating as middling when clean. After several years' cultivation the product ranges from 400 to 800 pounds per acre, the staple rating the same as that from fresh land. Crab-grass is the most troublesome. About 5 per cent. of land once cultivated now lies turned out.

Cotton is generally hauled to Wilmington during November by river and rail.

BRUNSWICK.

Population: 9,389.—White, 5,337; colored, 4,052.
Area: 814 square miles.—Woodland, 304,722 acres.
Tilled lands: 18,006 acres.—Area planted in cotton, 385 acres; in corn, 4,915 acres; in wheat, 8 acres; in oats, 240 acres.
Cotton production: 244 bales; average cotton product per acre, 0.63 bale, 903 pounds seed-cotton, or 301 pounds cotton lint.

Brunswick county lies on the west side of the Cape Fear river, and touches the Atlantic on the south. Its central and western portion is occupied by the great pocoson known as Green swamp, which, with its many projections, covers nearly half of the territory of the county. This swamp is bordered by wide tracts of canebrakes, and contains extensive areas of gum, cypress, and juniper swamps, which have been for half a century the center of a large lumber trade. The various streams which flow from this swamp to all points of the compass are bordered by oak flats, tracts of semi-swamp, and often by canebrakes, and in the body of it are numerous hummocks or flat ridges having a silty soil and a growth of short-leaf pine and small oaks. Between the arms of the swamp, on the narrow divides, and particularly in the southern portion of the county, near the sea-shore, are patches of long-leaf pine lands with sandy soils, and elsewhere of level piny woods, valuable for lumber and naval stores. Along the Cape Fear are large bodies of alluvial lands of unsurpassed fertility, which are among the best rice soils in this country. Waccamaw lake occupies the highest part of Green swamp, and covers an area of about 40 square miles. Naval stores and lumber are, of course, the principal interests, agriculture being of subordinate importance, and limited mainly to the cultivation of rice, of which its product is more than double that of any other county in the state. Of the county area, 3.46 per cent. is tilled land, of which 2.14 per cent. is cultivated in cotton.

ABSTRACT OF THE REPORT OF W. G. CURTIS, OF SMITHVILLE.

The chief soil cultivated in cotton is a *fine sandy loam*, and the most of the land in this region is of this description, extending fifty miles in each direction. Its natural timber is pine, intermixed with black-jack and other varieties of oak. The soil is gray to the depth of 6 inches, but the subsoil is heavier, being a clay intermixed with sand. The chief crops are corn, sweet potatoes, cotton, and rice, and the soil is about equally adapted to all, except that sweet potatoes will grow on poorer land than the others. The height usually attained by cotton is from 2½ to 3 feet, and it is most productive at that height. When planted on very rich lowlands, or on soils having a sandy subsoil, the cotton-plant is inclined to run to weed. Fresh land produces 900 pounds of seed-cotton per acre, 1,425 pounds making a 475-pound bale, which, when clean, rates as low middling and middling. After years of cultivation it rapidly depreciates, unless kept up by manuring, and 1,660 pounds are then needed for a 475-pound bale. The staple is much shorter than that from fresh land. Crab- and cane-grass are troublesome. Very little of such land originally cultivated now lies "turned out". It does very well after resting a year or two, but it is subject to gullying, and the damage is serious. The valleys are benefited by the washings of the uplands.

Shipments are made by rail and river, in December and January, to Wilmington; rate of freight per bale, 40 cents.

COLUMBUS.

Population: 14,439.—White, 8,926; colored, 5,513.
Area: 895 square miles.—Woodland, 357,014 acres.
Tilled lands: 38,293 acres.—Area planted in cotton, 2,113 acres; in corn, 15,723 acres; in wheat, 38 acres; in oats, 267 acres.
Cotton production: 930 bales; average cotton product per acre, 0.44 bale, 627 pounds seed-cotton, or 209 pounds cotton lint.

Columbus county lies farther inland and contains a larger proportion of upland piny woods soil than Brunswick. It is penetrated through all its parts by narrow belts of gum and cypress swamp and considerable tracts of oak and pine flats. The average soil of its upland piny woods is of moderate fertility, well adapted to the growth of cotton, but the richer swamp and gray-loam lands are devoted principally to corn. Brown marsh and White marsh are two large bodies of swamp in the eastern side of the county, and Gum swamp and others of less extent are found in the south and west. The production of cotton, potatoes, and rice divides with lumber and naval stores the interest of its people. Marl is found in several parts of the county. Of the county area 6.69 per cent. is tilled land, of which 5.52 per cent. is cultivated in cotton.

ABSTRACT OF THE REPORT OF D. S. COWAN, OF ROBESON.

The oak and hickory ridges have a light loam soil and a clay subsoil. The pine lands are stiff and heavy, and have a clay subsoil, generally underlaid with hard-pan. Marl underlies this whole region. Cotton in the lowlands runs to weed, and does not fruit well. The kinds of soils cultivated in cotton are: first, the oak and hickory ridges; second, the lowlands of Livingston creek above overflow; third, the cypress swamps, reclaimed. The *oak and hickory* is the chief soil, the proportion of this kind of land being about 40 per cent. Its natural timber is pine, oak, hickory, dogwood, maple, holly, walnut, and chincapin. The soil is a light clay loam, prairie-like, the color being brown or orange red, which does not bake or become sticky, and the average thickness 9 inches. The subsoil is heavier, the color being generally a light red, sometimes gray, and sometimes underlaid with hard-pan, which is quite impervious, and contains a limy substance, underlaid by clay at from 1 foot to 3 feet. The chief crops are corn, potatoes, cotton, pease, oats, rye, and vegetables of every description, the soil suiting them all remarkably well. The proportion of cotton planted is one-tenth, which is most productive at 3½ feet, but in very wet weather it is apt to run to weed. Fresh land produces 800 pounds of seed-cotton per acre, 1,400 pounds making a 475-pound bale, which, when clean, rates as good middling. After four years' cultivation the yield is 500 pounds per acre, and then 1,425 pounds are needed to make a bale, but it does not compare favorably with that from fresh land. Cocklebur and hog-weed are most troublesome. About 5 per cent. of such land originally cultivated lies turned out, and when again taken in, if marled, it does well. It is subject to gullying on the slopes, but the damage is not serious.

The soil of the *level pine lands* (pine flats) is heavy, black, and smooth, with no sand in it, and forms about 20 per cent. of the lands. The average thickness of the soil is 2 inches. The subsoil is a sticky, fine clay, sometimes pure white, resembling kaolin, with hard-pan underneath, and impervious; it is difficult to till in wet and in dry seasons, and is too flat to drain cheaply. Native grasses for pasturing are apparently best adapted to this soil.

Cotton shipments are made in December by rail to Wilmington; freight, $1 per bale.

LONG-LEAF PINE REGION.

(Embraces the following counties and parts of counties: Gates, Hertford, Bertie, Northampton, Halifax, Nash, Edgecombe, Pitt, Greene, Martin, Wilson, Johnston, Wayne, Lenoir, Duplin, Sampson, Cumberland, Harnett, Moore, Richmond, Robeson, and Bladen.)

GATES.

Population: 8,897.—White, 4,973; colored, 3,924.
Area: 339 square miles.—Woodland, 101,616 acres.
Tilled lands: 48,821 acres.—Area planted in cotton, 5,707 acres; in corn, 21,946 acres; in wheat, 708 acres; in oats, 1,210 acres.
Cotton production: 1,863 bales; average cotton product per acre, 0.33 bale, 465 pounds seed-cotton, or 155 pounds cotton lint.

Gates county lies between the Chowan river and the Dismal swamp, of which it includes a considerable section. The body of the county consists of level piny uplands, with a sandy loam soil. It has a narrow strip of very sandy, long-leaf pine land near the Chowan river, and also in the southeastern corner of the county. Along the Chowan river and its tributaries are tracts of cypress swamp from 1 to 2 and 3 miles wide. Near the smaller streams are narrow tracts of pine and oak flats having a gray clay loam soil. (For details see very full account below, by Mr. Gatling.) Marl is found in the banks of the Chowan river and in the southern end of the county. Of the county area, 22.50 per cent. is under tillage, of which 11.69 per cent. is cultivated in cotton.

ABSTRACT OF THE REPORT OF J. J. GATLING, OF GATLINGTON.

The following kinds of soils are cultivated in cotton: No. 1, light soil, with red-clay foundation; No. 2, sandy soil, with sandy foundation; No. 3, clayey and stiff soils, with pipe-clay foundation. The chief one is a *light soil*, which forms about one-fourth of the lands in this region, and extends a considerable distance north, west, and east. Its natural timber is a mixed growth—pine, oak, dogwood, maple, holly, and sweet gum. The soil is a whitish gray or black, according to location, to the depth of from 6 to 8 inches. The subsoil is heavier than the surface soil, being a red clay, which in some places is mixed with sand, and is sometimes impervious, but not generally so. Corn, cotton, sweet and Irish potatoes, wheat, oats, pease, and peanuts are the chief crops. The land tills easily in dry seasons, is early and warm where it is well drained, and the soil is well adapted to all of the above-named crops. The height usually attained by the cotton-plant is about 3 feet, and it is most productive at that height; but it is inclined to run to weed on low, wet lands and in wet seasons, and efforts have been made to restrain it and to favor bolling through underdraining and high fertilization. Fresh land produces about 600 pounds of seed-cotton per acre, and about 1,425 pounds are needed for a 475-pound bale, which, when clean, rates in the market as low middling. After ten years' cultivation the yield is from 400 to 500 pounds per acre, and about 1,660 pounds are needed to make a bale, which rates nearly as good as that from fresh land. Dog-fennel, hog-weed, crab- and wire-grass, and in some places nut-grass, are very troublesome. About one-half of the soil now lies turned out, and will do very well when again cultivated. In some places it gullies readily on slopes, serious damage being done, and the valleys are injured to a considerable extent by washings of the uplands. Efforts have been made, with very good success, to check the damage by hillside ditching and underdraining.

The *sandy soil* is timbered with long-leaf pine, oak, beech, and black-jack. It is a whitish-gray fine silt, with an average thickness of 6 inches before its color changes into that of the subsoil, which is lighter than the surface soil, being a yellow mixture of sand and clay, not impervious, but absorbs freely, and contains black and white gravel, underlaid by sand. As to tilling qualities, it is heavy in wet and light in dry seasons, and is early, warm, and generally well drained. This soil is best adapted to corn, sweet and Irish potatoes, pease, and peanuts. Cotton is most productive at the height of 3 feet, and is apt to run to weed in very wet weather, for which high manuring, good culture, and early planting are used as a remedy. Fresh land produces about 700 pounds of seed-cotton per acre, and about 1,540 pounds will make a 475-pound bale, and when clean the staple rates in the market as strict low middling. After ten years' cultivation the yield is 300 pounds per acre, and about 1,540 pounds are then needed to make a bale, but its staple rates as good as that from fresh land. Crab- and nut-grass are the most troublesome weeds. A considerable portion of the land originally cultivated now lies turned out; rest improves it very much for a short time, say three years. No damage is done by washing on the slopes, but the valleys are perceptibly improved by the washings of the uplands.

Stiff land and clay soils constitute about one-third of the lands of the county, extending about 6 miles north and south, and are timbered with heavy oak, large yellow pine, ash, poplar, beech, and holly. It is a whitish gray and black (varying in different sections) heavy clay loam to the depth of from 4 to 6 inches, when it changes into the subsoil, which is heavier than the surface soil described as a white clay; it is very sticky when wet and hard and brittle when dry, and is underlaid by gravel and rock in some places at 6 feet. The soil is difficult to till in wet and hard in dry seasons, and is best adapted to wheat, oats, and other small grain. A very small proportion of cotton is planted on these soils, and the plant is most productive at the height of 3 feet. Thorough draining, good culture, and high fertilization are used to restrain it from running to weed and to favor bolling. Fresh land produces from 600 to 700 pounds of seed-cotton per acre, about 1,425 pounds being needed to make a 475-pound bale. After ten years' cultivation it produces very little, and it does not pay to cultivate it when worn down. Cotton on lowlands is more liable to disease, such as blight, sore-shin, rust, runs too much to weed, grows too late, and is liable to be killed by frost. Hence we prefer upland for cotton where the soil is good and red clay lies near the surface. Such land is more susceptible of improvement, is more easily cultivated, can be planted ten or fifteen days sooner, yields a better quality of lint, and yields better every way.

Cotton shipments are made to Norfolk, by rail and by steamboat. Rate of freight per bale, $1.

HERTFORD.

Population: 11,843.—White, 5,122; colored, 6,721.
Area: 376 square miles.—Woodland, 119,330 acres.
Tilled lands: 53,625 acres.—Area planted in cotton, 14,605 acres; in corn, 25,521 acres; in wheat, 817 acres; in oats, 1,800 acres.
Cotton production: 6,360 bales; average cotton product per acre, 0.44 bale, 621 pounds seed-cotton, or 207 pounds cotton lint.

Hertford county lies on the northern border of the state, and is bounded eastward by the Chowan river. The soils are for the most part of the general region of upland piny woods lands, but near the water-courses there are considerable tracts of oak and pine flats and alluvial land. Along the margin of the Chowan and some of the other water-courses are fringes of gum and cypress swamp. Marl in abundance underlies the surface. Besides the culture of cotton and corn, there are the fish, lumber, and naval-stores industries. Of the county area, 22.28 per cent. is tilled land, of which 27.24 per cent. is cultivated in cotton. Cotton, lumber, and other products are shipped by steamer and rail to Norfolk.

ABSTRACT OF THE REPORT OF JUDGE DAVID A. BARNES, OF MURFREESBORO'.

The soils of most importance are the *sandy uplands*, which have clay subsoils and a timber growth of oak, dogwood, and pine; thickness from 3 to 4 inches. The chief crops are corn, cotton, pease, and sweet potatoes. The proportion of cotton planted is one-third, which runs to weed in wet seasons, the remedy for which is a free use of fertilizers, especially dissolved bone. Fresh land produces 800 or 900 pounds of seed-cotton per acre, from 1,425 to 1,540 pounds making a bale. Crab-grass is the most troublesome pest in cotton cultivation. About one-third of this land once cultivated lies turned out. It washes on slopes, doing some damage, while the valleys are improved.

BERTIE.

Population: 16,399.—White, 6,815; colored, 9,584.
Area: 689 square miles.—Woodland, 184,070 acres.
Tilled lands: 82,377 acres.—Area planted in cotton, 19,455 acres; in corn, 37,735 acres; in wheat, 309 acres; in oats, 2,403 acres.
Cotton production: 7,290 bales; average cotton product per acre, 0.37 bale, 534 pounds seed-cotton, or 178 pounds cotton lint.

Bertie county lies south of Hertford, in the angle between the Roanoke and Chowan rivers, and consists for the most part of level piny uplands, having a sandy loam soil; but the northern part of it is largely pine flats, having an infertile ash-colored, fine sandy soil. The southern part, near the Roanoke river, and along its chief tributary, the Cashie, are wide tracts of level oak and pine lands, which are very productive. The Roanoke river through almost the whole length of this county is bordered by a tract of alluvial lands from 3 to 6 miles wide, subject to annual overflows, and covered with heavy forests of cypress, maple, ash, etc., which are among the most fertile of the continent. In the middle region, on and near the Cashie and its tributaries, are considerable bodies of valuable swamp and semi-swamp lands. Cotton, corn, potatoes, fish, and lumber make up the list of industries of this county. Marl is found in the southern and middle sections. Of the county area, 18.68 per cent. is in tilled land, of which 23.62 per cent. is cultivated in cotton.

ABSTRACT OF THE REPORTS OF E. E. ETHERIDGE, OF COLERAIN, AND J. B. CHERRY, OF WINDSOR.

Cotton is generally planted on the *uplands*, which are light, having clay bottoms. These form the larger portion of the cotton lands, and extend all over the county. The timber is mostly pine. The subsoil is heavier, being a red, yellow, or white clay. The chief crops are corn, cotton, oats, and Irish and sweet potatoes, but the soil is best adapted to corn and potatoes. Cotton occupies about one-third of the tilled land, and grows to 3½ feet in height. It inclines to run to weed in warm, moist weather, which indicates a bad crop, and topping is the only remedy used to restrain it. Fresh land produces 650 pounds of seed-cotton per acre, 1,485 pounds being needed for a 475-pound bale, which grades as low middling. After years of cultivation the soil makes very poor cotton. Crab-grass is the most troublesome weed. A considerable amount of land once cultivated now lies turned out. It washes and gullies very readily on the slopes, and the valleys are injured to a considerable extent by the washings of the uplands.

Cotton shipments are made in October and November, by steamboat, to Norfolk and Baltimore. Rates of freight are $1 to $1 25 per bale.

NORTHAMPTON.

Population: 20,032.—White, 7,987; colored, 12,045.
Area: 557 square miles.—Woodland, 144,779 acres.
Tilled lands: 96,565 acres.—Area planted in cotton, 36,219 acres; in tobacco, 36 acres; in corn, 45,224 acres; in wheat, 1,725 acres; in oats, 4,805 acres.
Cotton production: 13,616 bales; average cotton product per acre, 0.38 bale, 537 pounds seed-cotton, or 179 pounds cotton lint.

Northampton county is situated between the Virginia border and the Roanoke river. Its soils belong to the general region of level piny uplands, merging toward the western limit into oak uplands and a more hilly surface, with an elevation of 150 feet above sea-level. Its numerous streams have general fringes of oak flats, alluvions, or gum and cypress swamps, and the Roanoke river has in its extensive "bottoms" some of the best corn lands in the state. Of the county area, 27.09 per cent. is tilled land, of which 37.51 per cent. is cultivated in cotton. For further details, reference may be had to the report of J. B. Macrae.

ABSTRACT OF THE REPORT OF J. B. MACRAE, OF JACKSON.

The low grounds alluvial soils of the Roanoke river, are cultivated only in corn. The next body of land is 4 feet above the highest water mark of freshets, and about 25 feet above the low grounds. Then comes the section of the county known as "piny woods".

The best land in this section for cotton is a peculiar *gray soil* having a hard red-clay subsoil, and commonly designated "piny woods", which occupies two-thirds of the county and is timbered with short-leaf pine and red or black oak. The color before it changes into that of the subsoil is whitish gray to the depth of 6 inches. The chief crops are cotton and corn, and the soil is well adapted to both. Three-fourths of the tilled land is planted in cotton. The plant is most productive when 2½ feet high, and inclines to run to weed when there is an unusual quantity of rain. Fresh land produces 1,200 pounds of seed-cotton per acre, and 1,485 pounds are needed for a 475-pound bale of lint, which rates as middling when clean. After three years' cultivation the product is 500 pounds per acre, and the staple is much shorter than that from fresh land. Crab-grass gives most trouble in cultivation, especially in damp, warm weather. One-fourth of the land once cultivated now lies turned out. Cotton shipments are made from the 1st of October by rail to Norfolk; the rate of freight is $2 25 per bale.

HALIFAX.

Population: 30,300.—White, 9,137; colored, 21,163.
Area: 682 square miles.—Woodland, 178,508 acres.
Tilled lands: 130,219 acres.—Area planted in cotton, 43,206 acres; in corn, 44,790 acres; in wheat, 1,300 acres; in oats, 4,497 acres.
Cotton production: 16,661 bales; average cotton product per acre, 0.39 bale, 549 pounds seed-cotton, or 183 pounds cotton lint.

Halifax county lies between the Roanoke river on the north and Fishing creek, one of the confluents of the Tar river, on the south. The eastern and larger part of this county belongs to the normal type of upland piny woods, the western third to the oak uplands. Long-leaf and short-leaf pines are commonly mingled with a subordinate growth of oaks, hickory, dogwood, etc. The surface is generally level or a little rolling, with small, often abrupt, hills and ravines near the streams. The soil is a gray, sandy loam, with a yellow to brown subsoil. The creeks and larger streams nearly all flow southward into the Tar river, the water-shed, according to a curious topographical law previously referred to, lying quite close to the south bank of the Roanoke. The western section belongs in large part to the oak uplands region, having its characteristic gray, yellow, and reddish clay loam and sandy loam soils and rolling surface and predominant oak forests, with an intermixture of short-leaf pine. The crops of this section are largely grains (corn, wheat, etc.) and tobacco. The bulk of the cotton product is made in the eastern section.

The streams in the eastern section have often narrow, swampy tracts of gum and cypress along their margins, but there are extensive alluvial areas or bottoms on the larger rivers, especially the Roanoke, whose bottoms are of unsurpassed fertility. In the great bend of Scotland Neck are some of the finest cotton lands of the state. Marl is abundant in the middle and eastern sections. Halifax is one of the most prosperous cotton counties, and produces very large crops of grains besides, chiefly of corn, of which the product is nearly half a million bushels. Of the county area, 32.12 per cent. is tilled land, of which 33.18 per cent. is cultivated in cotton.

ABSTRACT OF THE REPORT OF R. H. SMITH, OF SCOTLAND NECK.

(Messrs. J. H. Parker, of Enfield, and J. N. Smith, of Scotland Neck, also furnished reports.)

The upland soils vary greatly from a light sandy soil to a stiff clay, and are found in patches of from 20 to 200 acres. The climate for cotton being a short one, the plants on the bottom lands grow too much to weed and too late, subjecting the crop to damage from early frost. The uplands, with suitable soils and proper fertilizers, are esteemed the best for cotton; but old lands are generally preferable to new when well manured.

The chief soil is a *fine clay loam* from 8 to 12 inches deep, the color of which is brown, and the subsoil is a red and yellow clay. This class of land constitutes one-fifth of the arable uplands, and has a growth of red oak, holly, hickory, poplar, etc. The crops are corn, cotton, oats, wheat, and pease, but the soil is best adapted to cotton and wheat. Cotton is planted on two-fifths of the uplands, and is most productive when 3½ feet in height. It inclines to run to weed in a wet August and September, and topping favors bolling. Fresh land produces from 800 to 1,000 pounds of seed-cotton per acre, 1,485 pounds making a 475-pound bale of lint, rating as low middling. After ten years' cultivation the product is 400 pounds per acre, the staple, when clean, rating about the same as that from fresh land, sometimes better. Crab-grass and hog-weed are most troublesome. No serious damage is done by gullies on the slopes.

The *sandy loam of the creek uplands* has a gray color to the depth of 10 inches and a subsoil of red, white, and yellow clay. It is easy to till, early, warm, and well drained, and is best adapted to cotton, corn, and pease, about one-fifth of the uplands being planted in the former. Cotton is most productive at the height of 3 feet. The product from fresh land ranges from 800 to 1,000 pounds of seed-cotton per acre, from 1,485 to 1,540 pounds being required to make a 475-pound bale, which rates, when clean, as low middling. After ten years cultivation the yield is 400 pounds per acre, the staple being quite as good as that from fresh land.

A *light gravelly loam* occupies one-fifth of the lands in this region. It is gray in color to the depth of 8 inches, when it changes into that of the subsoil, a yellow sand for 2 or 3 feet, then red and yellow clay. Its natural timber growth is pine, oak, and dogwood.

Cotton shipments are made in October, November, and December, by steamboat and rail, to Norfolk and Baltimore. Rates of freight per bale are $1 50 to Norfolk and $2 to Baltimore.

The report of Mr. J. N. Smith, of Scotland Neck, agrees substantially with the preceding.

The report of Mr. Parker adds several points: That the eastern half of the county is level and rolling and well adapted to cotton, but the western half, being hilly, is not suitable for cotton culture. The chief soil, a *gray upland*, extends 20 miles north, 60 miles south, 80 east, and 15 west. Tarboro' is the center of a fine cotton section with a radius of 50 or 60 miles, the natural growth being long- and short-leaf pine, oak, hickory, dogwood, sweet gum, etc. The soil is a fine sandy loam 12 inches deep. In the eastern section two-thirds of the tilled land is in cotton; in the western, from one-third to one-half.

NASH.

Population: 17,731.—White, 9,417; colored, 8,314.
Area: 595 square miles.—Woodland, 193,247 acres.
Tilled lands: 82,238 acres.—Area planted in cotton, 25,768 acres; in tobacco, 27 acres; in corn, 32,490 acres; in wheat, 3,787 acres; in oats, 3,875 acres.
Cotton production: 12,567 bales; average cotton product per acre, 0.49 bale, 696 pounds seed-cotton, or 232 pounds cotton lint.

The general topographical and agricultural features of Nash county correspond quite closely to those of Halifax, to which its situation is similar. It lies south of that county, and also on the borders of the oak uplands, to which the western part of it belongs. It is drained for the most part by the Tar river and its numerous tributaries, along which are narrow strips of alluvial soil with oak forests and occasional cypress swamps. The divides between these streams through the middle and eastern portions of the county belong to the region of level upland piny woods, the growth being a mixture of long-leaf and short-leaf pine, with oak, hickory, dogwood, etc. These soils are well adapted to the culture of cotton, and are of average fertility. The soils inmany places in the western section are red or yellowish clay loams. This county lies largely within the area of the most productive cotton section of the state; the corn and potato crops are also important. Marl is abundant in the eastern part, but has not been extensively used. Of the county area 21.60 per cent. is tilled land, of which 31.33 per cent. is cultivated in cotton.

ABSTRACT OF THE REPORT OF J. M. MAYO, OF WHITAKER.

The uplands are preferable for cotton, as it grows too late on the lowlands and is liable to be killed by early frosts. The chief soil is *light gray*, having a clay subsoil, three-fourths of the uplands being of this description, and is timbered with oak, pine, poplar, sweet gum, and dogwood. The chief crops are cotton, corn, wheat, rye, and sweet and Irish potatoes, and it seems well adapted to all; but the proportion of cotton planted is at least half of the cultivated lands. The plant inclines to run to weed in wet weather, the only remedy for which is to plant as early as practicable and cultivate rapidly. The product from fresh lands ranges from 1,200 to 1,500 pounds of seed-cotton per acre, and 1,425 pounds will make a bale; clean staple rates as middling. After three years' cultivation the yield is about 400 pounds per acre. Rag- and hog- weed and crab-grass are most troublesome. About one-third of the land once cultivated now lies turned out, and rest improves it. The soil on the slopes in the light lands is subject to wash or gully, and efforts are made to remedy this by horizontalizing and hillside ditching with good success, but it requires constant attention.

The *stiff bottom lands* are found only on the creeks, rivers, branches, and swamps, and cover a small portion of the county. They are timbered with gum, oak, dogwood, beech, elm, and poplar. The soil is a blackish or brown heavy clay alluvium; the subsoil a bluish clay, sometimes a white sand, or yellow sand and yellow clay. Very little cotton is planted on this soil.

The Tar river bottoms occupy a very small portion of the lands. They are timbered, and are of the same character as the stiff bottom lands.

Cotton shipments are made by rail to Norfolk, Petersburg, Baltimore, and New York, and the rates of freight per bale are from $1 95 to $3 50.

EDGECOMBE.

Population: 26,181.—White, 7,968; colored, 18,213.
Area: 567 square miles.—Woodland, 125,083 acres.
Tilled lands: 132,875 acres.—Area planted in cotton, 51,880 acres; in corn, 46,235 acres; in wheat, 2,422 acres; in oats, 9,589 acres.
Cotton production: 26,250 bales; average cotton product per acre, 0.51 bale, 720 pounds seed-cotton, or 240 pounds cotton lint.

Edgecombe is a typical county of the long-leaf pine region. It is traversed through its middle portion by the Tar river, and is drained by its numerous tributaries. The soils are characteristically gray, sandy loams, with a yellow to brown subsoil, and belong to the region of level piny uplands. Along the borders of the various streams are frequent and extensive tracts of alluvial lands, and on some of them occur cypress and gum swamps. This is one of the leading cotton counties of the state, and on the percentage cotton map it will be seen to occupy the center of one of the zones of greatest production. It stands second among the counties of the state in its product of cotton, and its corn crop is also among the largest. The long-leaf pines, which were once found abundant over the whole surface of this county (and region), have been thinned until they are a subordinate element, so that the remaining forests are mainly of short-leaf pine and oak.

Both commercial fertilizers and the native marls have been more largely used than elsewhere in the state, and, in connection with compost, most effectively, so that Edgecombe has long been foremost in this special agriculture of the east. Of the county area, 36.62 per cent. is tilled land, 39.27 per cent. of the latter being cultivated in cotton. It has the advantage of both river and railroad transportation.

ABSTRACT OF THE REPORTS OF MESSRS. ELIAS CARR, OF OLD SPARTA, AND J. L. BRIDGES, OF TARBORO'.

The chief soil cultivated in cotton is what is designated as "*piny wood land*", which occupies from three-fourths to four-fifths of the and in this region, and extends 40 miles north, east, and west, and south to the South Carolina line. The natural timber is long- and short-leaf pine, oak, gum, hickory, and dogwood. The color of the soil is blackish when new, wearing white with age. The average thickness of the surface soil is 4 inches, when it changes into that of the subsoil, which is generally a yellow sand, with a very small percentage of clay. The soil is easy to till at all seasons. The chief crops are cotton, corn, wheat, and oats, but the proportion of cotton planted is about one-half of the whole acreage. The plant is most productive when 3 feet high, and only inclines to run to weed on fresh and ill-drained land, but it is improved by draining and marling. Fresh land produces from 400 to 1,000 pounds of seed-cotton per acre, from 1,400 to 1,540 pounds of cotton being required to make a 475-pound bale of lint, which rates as low middling when clean. After ten years' cultivation the yield is almost nothing. We manure from the beginning. Crab-grass is the most troublesome weed.

The quantity of cotton grown on other soils is insignificant. Bottom lands have a growth of gum, cypress, etc., and they are best adapted to corn and oats.

Cotton shipments are made in November and December, by water, to Norfolk and New York. Rates of freight are $1 40 to the former and $2 35 to the latter per bale.

The reports of Messrs. J. J. Battle, of Rocky Mount, and W. G. Lewis, of Tarboro', agree in most points with he above. They add that the spring is too late and the fall too early to realize full crops. Cotton runs to weed from overmanuring and excessive moisture in August, especially after a dry June and July, and the most troublesome weeds are hog-weed and crab-grass.

PITT.

Population: 21,794.—White, 10,704; colored, 11,090.
Area: 657 square miles.—Woodland, 217,222 acres.
Tilled lands: 103,302 acres.—Area planted in cotton, 31,147 acres; in corn, 46,482 acres; in wheat, 3,787; in rye, 284 acres; in oats, 3,301 acres.
Cotton production: 14,879 bales; average cotton product per acre, 0.48 bale, 681 pounds seed-cotton, or 227 pounds cotton lint.

The description of Edgecombe county applies, with scarcely a change, to this county also. The only mentionable difference is that it contains perhaps a larger proportion of swampy lands, both along the Tar river and its main tributaries and the two Cotentneys. The body of its area is the normal level, upland, piny woods, with their usual soils and forests. It is also one of the best cotton counties, and its grain crop is larger in proportion than that of most of the cotton counties, exceeding 500,000 bushels. Its product of rice and potatoes is also of considerable importance. Marl is abundant, and is used with the best results, as in Edgecombe. Of the county area, 24.57 per cent. is tilled land, and 30.15 per cent. of the latter is cultivated in cotton.

ABSTRACT OF THE REPORTS OF W. M. B. BROWN, OF GREENVILLE, AND JAMES JOYNER, OF MARLBORO'.

The uplands are known as "piny wood lands"—the very best lands for improvement—intersected by small streams just sufficient for drainage. On the lowlands cotton is prone to grow too late and be caught by frost; hence uplands are preferred for cotton, and as we are in the marl belt, a great abundance of which is found convenient to almost every farm, the use of this as a fertilizer we find to be especially valuable for all crops when used on the piny woods.

The chief soil cultivated in cotton is the *piny woods*, which occupies from three-fourths to four-fifths of the lands in the region and embraces the whole of Greenville township, except the bottoms of the river and the swamps. Its natural timber is pines, with oak, hickory, gum, and maple. The surface soil, from 6 to 8 inches deep, is of a gray yellow color, blackish in swamp and river bottoms. The piny woods are almost always underlaid with red or yellowish clay, with marl in the branches or small streams. This soil is best adapted to cotton, corn, and small grain, the bottoms being best adapted to corn, the sandy belt to small grain. Cotton occupies one-half of all cultivated land, and generally attains a height of 3 feet, but it is inclined to run to weed in wet seasons. Fresh land produces from 1,000 to 1,200 pounds of seed-cotton per acre, 1,425 pounds being required to make a 475-pound bale of lint, which rates as low middling when clean. After five years' cultivation the product is 400 pounds per acre, but the staple rates the same. Crab-grass gives most trouble. Not much land once in cultivation now lies turned out.

Cotton shipments are made by steamboat to Norfolk and New York. The rate of freight is $1 35 to Norfolk, and $2 50 to New York.

GREENE.

Population: 10,037.—White, 4,652; colored, 5,385.
Area: 257 square miles.—Woodland, 82,432 acres.
Tilled lands: 75,084 acres.—Area planted in cotton, 16,988 acres; in corn, 25,148 acres; in wheat, 3,638 acres; in rye, 394 acres; in oats, 1,738 acres.
Cotton production: 8,020 bales; average cotton product per acre, 0.47 bale, 672 pounds seed-cotton, or 224 pounds cotton lint.

The small county of Greene, adjoining Pitt on the south, and drained by the Cotentney (which crosses it through the middle) and its numerous tributaries, has the same general features, both as to its natural characteristics and as to the development of its agriculture, as Edgecombe county, but there are considerable areas of sandy pine lands and pine flats in the eastern angle and in the southern section. Its streams are also for the most part bordered by narrow fringes of alluvial land and of gum and cypress swamps. It has also along the courses of some of its tributaries considerable tracts of semi-swamp land, characterized by a dark gray loam of great fertility, notably Lousin swamp, near the southern border. Like the preceding counties, Greene finds marl and compost essential to successful cotton farming. There are still considerable areas of pine and cypress timber in the county. Of the county area, 45.65 per cent. is tilled land, of which 22.63 per cent. is cultivated in cotton.

ABSTRACT OF THE REPORTS OF W. P. GRIMSLEY AND W. E. BEST, OF SNOW HILL.

About one-third of the land in this region is what is termed very *sandy*, one-fourth of which is planted in cotton. Its natural timber is pine, oak, and hickory. The soil is whitish-gray in color to the depth of 5 inches, when it changes into that of the subsoil, which is heavier than the surface soil, and is of a yellowish color. The chief crops are corn, cotton, wheat, rye, oats, and sweet and Irish potatoes. Cotton usually attains a height of from 20 to 30 inches, is generally most productive when 24 inches high, and is not inclined to run to weed on this soil. Fresh land produces from 600 to 800 pounds of seed-cotton per acre, 1,425 pounds making a 475-pound bale. After two years' cultivation the product is 600 pounds per acre, 1,485 pounds being required to make a bale. Carrot and crab-grass are most troublesome. About one-tenth of such land once cultivated now lies turned out.

The *sandy loam*, with a clay subsoil, occupies nearly two-thirds of the land, one-half of which is planted in cotton, its natural timber being pine, oak, and hickory. The average thickness of the surface soil is 5 inches, which is easy to till, and is best adapted to cotton, corn, wheat, and oats. Cotton grows from 3 to 4 feet in height, but is most productive when 4 feet high. The product from fresh land ranges from 1,000 to 1,200 pounds of seed-cotton per acre, and after two years' cultivation from 800 to 900 pounds, but there is no difference in the staple. About one-tenth of the land once cultivated now lies turned out, but when again taken in it does well.

The *swamps or lowlands* occupy one-twentieth of the lands in this region, and are timbered with gum, poplar, ash, maple, and bay. This soil is best adapted to corn, very little cotton being planted.

Cotton shipments are made by flat-boats to New Berne at $1 per bale.

MARTIN.

Population: 13,140.—White, 6,661; colored, 6,479.

Area: 482 square miles.—Woodland, 175,116 acres.

Tilled lands: 56,377 acres.—Area planted in cotton, 13,444 acres; in corn, 24,209 acres; in wheat, 940 acres; in oats, 1,447 acres.

Cotton production: 6,383 bales; average cotton product per acre, 0.47 bale, 678 pounds seed-cotton, or 226 pounds cotton lint.

Martin county is bordered on the north by the very tortuous course of the Roanoke river, the tributary waters of which for the most part drain it northward into that river. The larger part of its territory belongs to the region of level piny uplands, having a gray sandy loam soil. The higher ridge land, near the south bank of the Roanoke river, has a soil lighter and more sandy, and is characterized by a considerable admixture of long-leaf pine, and the average proportion of oaks and short-leaf pine, etc. Along the Roanoke and some of its tributaries there are extensive bottoms or alluvial lands, and about the head streams of its tributaries considerable tracts of swamp land.

The agriculture of the county corresponds in its main features to that of Edgecombe and the adjacent counties, but its soils are less productive, and its agriculture is less advanced, partly because of its large and profitable lumber industry in the great cypress swamps of the Roanoke. Marl is abundant, and is used to a moderate extent. Of the county area, 18.28 per cent. is tilled land, of which 23.67 is cultivated in cotton.

ABSTRACT OF THE REPORTS OF J. R. LANIER AND WILLIAM SLADE, OF WILLIAMSTON.

Our uplands are much better suited to cotton culture than the bottoms or lowlands, as we have barely season enough to grow cotton to perfection. We cannot get an early start on the bottom lands in the spring.

The common designation of the chief soil is *piny wood levels*, three-fourths or more of the county being of this kind, extending all through this and many of the adjoining counties. Its timber is mostly long-leaf or pitch pine, short-leaf pine, oak, and dogwood. The average thickness of the surface soil is from 6 to 20 inches, when it changes into the subsoil, which is mostly of a pale red or yellowish color. The chief crops are cotton, corn, wheat, oats, and sweet potatoes, and the soil, when well fertilized, is well adapted to all. The proportion of cotton planted is about one-fourth or three-sevenths of this soil. It attains a height of from 2½ to 3 feet, at which it is most productive. It inclines to run to weed when planted late on cold, rich bottom land, and in wet seasons, the best remedy for which is kainit. Fresh land produces in a good season from 1,000 to 1,500 pounds of seed-cotton per acre, 1,425 pounds making a bale of lint. After two years' cultivation the product ranges from 600 to 800 pounds per acre, the same number of pounds being required for a bale. Carrot- and hog-weeds are most troublesome. Considerable damage is done in places by wash or gullies on the slopes.

Cotton shipments are made by steamboat to Norfolk, Baltimore, and New York, at the rates of $1 to Norfolk, $1 50 to Baltimore, and $2 to New York.

WILSON.

Population: 16,064.—White, 8,655; colored, 7,409.

Area: 376 square miles.—Woodland, 114,530 acres.

Tilled lands: 65,255 acres.—Area planted in cotton, 23,706 acres; in corn, 27,288 acres; in wheat, 2,804 acres; in oats, 1,590 acres.

Cotton production: 13,049 bales; average cotton product per acre, 0.55 bale, 783 pounds seed-cotton, or 261 pounds cotton lint.

Wilson county lies on the western border of the long-leaf pine belt, and its soils belong almost exclusively to the region of level upland piny woods, and correspond to those of Edgecombe. This county is traversed by numerous streams, the most notable of which is the Cotentney, along which, as well as its tributaries, are found considerable tracts of alluvial land and swamps (gum and cypress). In all respects the agriculture of this county repeats that of Edgecombe both as to practice and as to results. It will be seen, by reference to the cotton percentage map that this territory also belongs to the region of highest production. Marl is found in the easter half of the county. Of the county area, 27.12 per cent. is tilled land, of which 36.33 per cent. is cultivated in cotton.

JOHNSTON.

Population: 23,461.—White, 15,996; colored, 7,465.

Area: 689 square miles.—Woodland, 29,966 acres.

Tilled lands: 104,407 acres.—Area planted in cotton, 32,193 acres; in tobacco, 36 acres; in corn, 45,045 acres; in wheat, 3,711 acres; in rye, 324 acres; in oats, 3,176 acres.

Cotton production: 15,151 bales; average cotton product per acre, 0.47 bale, 672 pounds seed-cotton, or 224 pounds cotton lint.

Johnston county lies on the upper waters of the Neuse river and its larger tributaries, which traverse it in a southeast direction, and consists for the most part of level and gently rolling piny uplands, with a few small bodies of more sandy and barren pine lands. It lies on the western margin of the long-leaf pine region, its southeastern half being characterized in its general features by the same soils and growth as the average of that belt, while along the northwestern margin the lands are more hilly and the piny belts are alternated along the streams and more hilly portions with oak and pine forests and gravelly loam soils. There are tracts of quite sandy soil in the eastern section, while in the middle section are large bodies of pine flats. Johnston is one of the most prosperous counties, as besides its large cotton crops the grain product reaches nearly 500,000 bushels, and its crop of potatoes exceeds 200,000 bushels. Of the county area, 23.68 per cent. is tilled land, of which 30.83 per cent. is cultivated in cotton.

ABSTRACT OF THE REPORT OF E. J. HOLT, OF PRINCETON.

The chief soil cultivated in cotton is the *pine lands*, which have a gray sandy soil, occupy about one-half of all the upland, and extend 40 miles west, 20 miles south, about 50 miles east, and north to the Virginia line, about 100 miles. Its natural timber is pitch-pine, oak, hickory, etc. The average thickness of the surface soil is from 4 to 6 inches before its color changes into that of the subsoil, which is a yellow clay, mixed with sand.

The chief crops are cotton, corn, oats, potatoes, pease, and wheat, but the soil is apparently best adapted to cotton, which crop occupies about one-third of all the cultivated lands. Cotton grows from 2 to 5 feet, but is most productive when 4 feet high. It inclines to run to weed in wet and warm weather. Fresh land produces from 600 to 1,000 pounds of seed-cotton per acre, 1,425 pounds being required to make a 475-pound bale of lint, which rates in the market as low middling when clean. After ten years' cultivation the product ranges from 300 to 500 pounds per acre, the staple rating about the same as that from fresh land. Crab-grass and Jamestown weed are most troublesome.

Cotton shipments are made as fast as baled by rail to Goldsboro' at 60 cents per bale.

WAYNE.

Population: 24,951.—White, 12,827; colored, 12,124.
Area: 601 square miles.—Woodland, 188,130 acres.
Tilled lands: 122,102 acres.—Area planted in cotton, 32,103 acres; in tobacco, 198 acres; in corn, 44,469 acres; in wheat, 7,041 acres; in rye, 819 acres; in oats, 1,779 acres.
Cotton production: 14,558 bales; average cotton product per acre, 0.45 bale, 645 pounds seed-cotton, or 215 pounds cotton lint.

Wayne county lies eastward of the Johnston county, south of Wilson county, and west of Greene, on the waters of the Neuse, which crosses its middle portion and drains almost the whole of it directly and by its tributaries. This county resembles in all respects the adjoining counties already described. Along the Neuse river and some of the other streams are considerable bodies of alluvial land and semi-swamp, and not infrequently fringes of cypress and gum swamp. Along the south bank of the Neuse is a narrow zone of pine barrens, conforming in its general trend to the curves of that river, and having a breadth of from 1 to 3 miles. Both this county and Johnston have still considerable areas of turpentine and timber lands.

The cotton and grain products of Wayne county are large, and those of rice and potatoes are considerable. There is an abundance of marl, and it has been used very profitably in former years; but latterly, as in the cotton region generally, commercial fertilizers have usurped the place of nearly all others. Of the county area, 31.74 per cent. is tilled land, of which 26.29 per cent. is cultivated in cotton.

ABSTRACT OF THE REPORT OF J. ROBINSON, OF GOLDSBORO'.

The uplands vary but little from one ridge to another, lying in tracts of from 100 to 2,500 acres each. Cotton on the lowlands is liable to be late, and therefore uplands are preferred.

The chief cotton soil is a *fine gray, sandy loam*, underlaid with clay, which occupies about three-eighths of the lands in this region and extends all over the county. It is timbered with oak and pines. The leading crops are cotton, corn, wheat, pease, and oats, and the soil seems well adapted to all. About one-fourth of the soil is planted in cotton, which attains the average height of 3 feet, but is most productive when 2½ feet high, and is apt to run to weed in excessive rainy, hot weather. Thorough draining and deep plowing will remedy this. Fresh land produces about 800 pounds of seed-cotton per acre, 1,425 pounds making a bale of lint, which, when clean, rates in the market as strict good ordinary. After three years' cultivation the product is 600 pounds per acre, 1,425 pounds making a bale, the staple rating lower than that from fresh land. Crab-grass and carrot-weed are most troublesome. About one-eighth of land once cultivated now lies turned out. The other soils are a fine, stiff, brown soil and a light sandy river soil.

Cotton is shipped by rail to New York at $2 50 per bale.

LENOIR.

Population: 15,344.—White, 7,277; colored, 8,067.
Area: 457 square miles.—Woodland, 122,571 acres.
Tilled lands: 83,943 acres.—Area planted in cotton, 19,150 acres; in corn, 29,838 acres; in wheat, 5,067 acres; in rye, 685 acres; in oats, 1,060 acres.
Cotton production: 8,235 bales; average cotton product per acre, 0.43 bale, 612 pounds seed-cotton, or 204 pounds cotton lint.

Lenoir county lies on the lower course of the Neuse, east of Wayne. The northern half consists of level piny uplands of the same character as those of the counties adjoining it on the north, having narrow tracts of swamp land along its water-courses, while in its western and northern parts there are wide tracts of level semi-swamp

lands, which are characterized by a dark, fine gray loam of great fertility. The southern half of the county, south of the Neuse, is characterized generally by a more sandy soil, and on the higher divides between the streams by narrow zones of pine barrens. The water-courses in this half of the county are also bordered by cypress and gum swamps, and to some extent by oak and pine flats. Shell marl (blue), chalk marl, and greensand are all found in this county, one or the other in almost every neighborhood. Of the county area, 28.72 per cent. is tilled land, of which 22.82 per cent. is cultivated in cotton. Means of transportation are furnished by steamboat and railroad to New Berne, Wilmington, and Norfolk.

DUPLIN.

Population: 18,773.—White, 10,587; colored, 8,186.
Area: 832 square miles.—Woodland, 288,505 acres.
Tilled lands: 69,314 acres.—Area planted in cotton, 9,654 acres; in corn, 36,813 acres; in wheat, 1,031 acres; in rye, 422 acres; in oats, 433 acres.
Cotton production: 4,499 bales; average cotton product per acre, 0.47 bale, 663 pounds seed-cotton, or 221 pounds cotton lint.

Duplin county lies southward of the two preceding counties, and partakes of their general topographical and agricultural features. It is drained by the Northeast Cape Fear river, which flows southward through its middle section, and both this and the numerous tributaries are bordered by belts of alluvial and often swampy lands. Near its northern and eastern borders are two small pocosons, and within its southern section lies one-half of the great Angola Bay pocoson, an almost impenetrable jungle of the average character of pocoson lands, with fringes of rich swamp lands on the streams that issue from it. This pocoson is flanked on the westward toward the Northeast Cape Fear river by a fringe of fertile white-oak flats and semi-swamp lands. Between the tributaries of the river, on the divides, are several tracts of sandy pine hills, which are very unproductive. The cotton lands, which are of limited extent, are the level piny woods of the usual description; but corn is a more valuable crop, and the product of potatoes and rice are of considerable importance. The county has still valuable resources in timber and turpentine lands. Marl (blue and white) is abundant, though but little used. Of the county area, 13.02 per cent. is tilled land, of which 13.93 per cent. is in cotton.

ABSTRACT OF THE REPORT OF J. A. BRYAN, OF KENANSVILLE.

(J. B. Oliver, of Mount Olive, also furnished a report.)

The uplands of the county, comprising all kinds of soils, after being fertilized, are planted in cotton to a small extent. These uplands are all sandy, but vary in color and quality. Drought in May retards the cotton growth and renders it too late to make a full crop, and excessive rains, with cold weather during the month of May and early in June, affect the plant. Excessive drought in July and August induces rust sometimes where the soil is not manured heavily, but otherwise the cotton-plant will thrive under as unfavorable weather as corn or the other crops usually raised in this county.

The soil principally cultivated in cotton is the *stiff upland or loamy soil*. About one-third of the land in this region is of this kind, and it occurs in all parts of the county in areas of from 5 to 1,000 acres each. Its timber growth is long- and short-leaf pine, black and sweet gums, oak, hickory, and black-jack. The soil is a fine sandy loam, which varies in color from a gray to buff, yellow, brown, black, and chocolate. The average thickness of the surface soil is from 10 to 12 inches, with a subsoil that is heavier and is of a yellow or red clay, that bakes hard when exposed to the sun. These clays have from 50 to 75 per cent. of sand in their composition. The soil is easy to till. Corn, pease, sweet potatoes, wheat, and cotton are the chief crops of the region, but the soil is best adapted to corn, cotton, and sweet potatoes. The most productive height of the cotton-plant is 4 feet, but it runs to weed on alluvial or creek bottoms where there is an excess of moisture and organic matter. Fresh lands produce 300 pounds of seed-cotton per acre, and 1,545 pounds will make a bale of lint. After four years' cultivation the product falls off, but the staple rates about the same. Crab-grass is the most troublesome weed. Very little land once cultivated now lies turned out.

The naturally drained land, or *sandy upland*, occupies one-third of this region, and extends 20 miles through the central portion of the county, not entirely uninterrupted, and is timbered with pine, black-jack, red oak, chincapin, hickory, and sourwood. The average thickness of the surface soil is 6 inches before its color changes into that of the subsoil, which varies from a red to yellow clay, while in places a brown sand intervenes between the soil and clay. It is easy to till, and is early, warm, and well-drained. The proportion of cotton planted is about one-twentieth of the area under cultivation. Fresh land produces about 200 pounds of seed-cotton per acre, 1,545 pounds of which make a bale of lint, rating as middling when clean.

Gallberry lands occupy one-thirtieth part of the county, but are located mostly in the southeastern part, and are timbered with pine, gum, maple, etc.

Cotton shipments are made by rail to Wilmington at $1 25 per bale of 450 pounds.

Mr. J. B. Oliver, of Mount Olive, divides the soils into *fine sandy uplands*, with red oak, short-leaf pine, hickory, and dogwood, amounting to one-eighth of the land, and having a soil 6 inches deep, one-fourth of its surface being planted in cotton; and *pine uplands*, with a long-leaf pine growth, making one-fourth of the lands in the section, one-fourth of which is in cotton. Another kind of land—*second pocoson*—timbered with water oak, white oak, overcup oak, rosemary pine (*P. tæda*), and sweet and blue gum, has a clay-loam soil 4 feet deep and a subsoil of whitish, sticky clay. Very little of this soil is planted in cotton, as it is better for corn. The troublesome weeds are hog-weed, yellow-top, and crab-grass. The seasons are short between late and early killing frosts, April 20 and October 20.

SAMPSON.

Population: 22,894.—White, 13,347; colored, 9,547.
Area: 964 square miles.—Woodland, 374,576 acres.
Tilled lands: 116,892 acres.—Area planted in cotton, 15,346 acres; in tobacco, 28 acres; in corn, 53,951 acres; in wheat, 1,249 acres; in rye, 409 acres; in oats, 654 acres.
Cotton production: 6,291 bales; average cotton product per acre, 0.41 bale, 585 pounds seed-cotton, or 195 pounds cotton lint.

Sampson county lies in the middle of the long-leaf pine belt, and much the larger part of its territory represents the average character of the soils and forests of that belt. It is drained by South river, one of the principal tributaries of the Cape Fear, whose streams divide its territory into north- and south-lying belts or zones—flattish swells, the higher portions of which are characterized by sandy soils and forests predominantly of long-leaf pine. In places near the southern and western margins, and again near the northern end, there are tracts which are quite sandy and approach the character of pine barrens. There are also extensive pine flats, especially on the waters of Six Runs, with here and there considerable bodies of pine and oak flats.

The corn crop of the county is much more important than that of cotton, reaching nearly 500,000 bushels, and the crops of potatoes and rice are both unusually large. There are also large bodies of virgin pine timber, still valuable both for turpentine and for lumber. Marl is abundant, and is used with the best results in some sections, chiefly the northern. Of the county area, 18.95 per cent. is tilled land, of which 13.13 per cent. is cultivated in cotton.

ABSTRACT OF THE REPORT OF A. A. M'KAY, OF CLINTON.

Cotton depends very much upon a warm spring, so that it can start up sufficiently to get out of the way of the grass. Since commercial fertilizers have come into use, the cotton has been so pushed that the frost in the fall scarcely ever catches it, or at least few green bolls are affected. The kinds of soils cultivated in cotton are generally a soil that is stiff, caused by the clay being near the surface, and the rich sandy loams.

The chief soil is a *clayey and sandy loam*, which occupies about two-thirds of the lands in this region, and is timbered principally with long-leaf pine; many oak ridges have a growth of maple, poplar, black and sweet gum, elm, hickory, cypress, juniper, ash, beech, holly, dogwood, and cedar. The chief crops are cotton, corn, pease, sweet potatoes, wheat, rye, oats, tobacco, etc., but the soil is best adapted to corn and cotton, and about one-fourth of every farm is planted in cotton. The plant usually attains a height of from 3½ to 4 feet, and is most productive at that height. It does not incline to run to weed, except on alluvial lands or lands very highly manured; topping favors bolling.

Fresh land produces about 750 pounds of seed-cotton per acre, about 1,425 pounds making a 475-pound bale of lint, which, when clean, rates in the market as low middling. After ten years' cultivation the yield per acre is 300 pounds. Cocklebur is the most troublesome weed. About two-fifths of land once cultivated now lies turned out, and when again taken in produces better than if cultivated every year. The valleys are improved by the washings of the slopes. Efforts have been made to check the damage done to the slopes, by plowing in curved lines and by hillside ditching, with profit to the lands and to the crops.

Cotton shipments are made in November by rail to Wilmington. The rates of freight are 50 cents per bale to Wilmington and $2 50 to New York. Most of the cotton in the county is sold to merchants in Clinton, the county-seat.

CUMBERLAND.

Population: 23,836.—White, 12,594; colored, 11,242.

Area: 982 square miles.—Woodland, 294,178 acres.

Tilled lands: 54,238 acres.—Area planted in cotton, 9,210 acres; in corn, 32,677 acres; in wheat, 1,141 acres; in rye, 1,513 acres; in oats, 1,509 acres.

Cotton production: 3,905 bales; average cotton product per acre, 0.42 bale, 603 pounds seed-cotton, or 201 pounds cotton lint.

Through the middle of Cumberland county, from its western margin, on the Moore county-line, to the Cape Fear river, which crosses the eastern side of the county, lies a broad, irregular zone of pine barrens with a very sandy and unproductive soil and an almost exclusive growth of long-leaf pine. On both sides of this zone, along the northern and southern sections of the county, with unimportant exceptions, and in the section eastward of the Cape Fear river, the soils belong to the class of gray sandy loams of the average upland piny woods. Near the river, on both sides, are large tracts of semi-swamp and oak and pine flats, which are very productive. Many of the streams which flow from the central pine barrens of the county contain narrow fringes of gum and cypress swamp, and the swampy tracts along the river often contain a considerable percentage of cypress. The turpentine and lumber interests are still important. Of the county area, 8.63 per cent. is tilled land, of which 16.98 per cent. is cultivated in cotton.

ABSTRACT OF THE REPORT OF O. EVANS, OF IDAHO.

The uplands are much better for cotton than the lowlands, but if the fall is late the lowlands are the best. The kinds of soil cultivated in cotton are sandy and clay loams. The *clay soil* is the chief, and occupies two-thirds of the land in this region, two-thirds of which is planted in cotton. It is timbered with sweet gum, pine, oak, etc. The chief crops are cotton and corn, but the soil is apparently best adapted to cotton. The plant is most productive when 2 feet high, and runs to weed in rich, damp lands. Fresh lands produce 1,000 pounds of seed-cotton per acre, and 1,425 pounds will make a 475-pound bale of lint. After five years' cultivation the product is 600 pounds per acre, the staple comparing favorably with that from fresh land. Cocklebur is the most troublesome weed. About one-fifth of the land once cultivated now lies turned out.

Cotton shipments are made in November and December, by rail and steamboat, to Wilmington and New York, and the rates of freight are from 75 cents to $1 50 per bale.

HARNETT.

Population: 10,862.—White, 7,092; colored, 3,770.

Area: 601 square miles.—Woodland, 175,096 acres.

Tilled lands: 42,173 acres.—Area planted in cotton, 9,281 acres; in tobacco, 32 acres; in corn, 21,244 acres; in wheat, 2,393 acres; in rye, 489 acres; in oats, 1,202 acres.

Cotton production: 3,627 bales; average cotton product per acre, 0.39 bale, 558 pounds seed-cotton, or 186 pounds cotton lint.

Harnett county lies on both sides of the Cape Fear river, on the northwestern margin of the long-leaf pine belt. Near the river, and for several miles on both sides, its surface is quite hilly in its upper portion, and here the soil is of the intermediate character described on page 16 as oak and pine sandy and gravelly hills. On the tops of the

ridges and river hills these soils are gray, sandy loams; but on the slopes they approach the character of clay loams, and are covered mainly with forests of oak and short-leaf pine. The body of the county belongs strictly to the long-leaf pine belt, and has the general characteristics of that region. The western section, as well as a narrow belt in the middle near the south bank of the river and some portions of the south side, partakes in part of the character of the pine barrens. Near the river, and along its principal tributaries from the west, and in the angles between these and the river, are wide tracts of gray, clayey, silty lands (oak and pine flats) and occasional narrow strips of gum and cypress swamp. Cotton production is the principal industry of the county, but grain, lumber, and turpentine are also important products. Of the county area, 10.96 per cent. is tilled land, of which 22.01 per cent. is cultivated in cotton.

ABSTRACT OF THE REPORT OF H. C. M'NEILL, OF LILLINGTON.

The upland soil does not vary much, and the only difference in the first two described is that there is some sand in one and none or very little in the other. The cotton in the lowlands is late and runs too much to weed, and is liable to be prematurely killed by frost.

The *gray upland soil* is a mixture of putty-like land and coarse sand, and such is nearly all the land between the Cape Fear and Little rivers for several miles before they unite. Its natural timber is oak, dogwood, sweet gum, hickory, and pine. The average thickness of the surface soil is 18 inches, and the subsoil is a clay or yellow loam, becoming by cultivation like surface soil. The chief crops are cotton, corn, wheat, and oats, but the soil is best adapted to cotton and corn. The proportion of cotton planted is one-half of the land cultivated; it attains the height of from 1 to 4 feet, and is most productive when from 2½ to 3 feet high. On new land, and in wet weather, it inclines to run to weed. Fresh land produces from 600 to 800 pounds of seed-cotton per acre, 1,480 pounds making a 475-pound bale of lint. After ten years' cultivation the product is from 300 to 400 pounds per acre. Hog-weed is the most troublesome.

The *gray upland dark-loam soil*, with very little or no sand, occupies about one-third of the lands in this region. It joins the Cape Fear bottoms, and extends about 10 miles. The thickness of the surface soil is 12 inches, over a subsoil of yellow clay, one-half of which is planted in cotton.

The *yellow-loam soil*, which runs alongside of the Cape Fear river, is to some extent subject to overflow. The proportion of cotton planted is very small, and the natural timber is heavy oaks and gums of both kinds. The subsoil is a red clay, becoming very hard when exposed, but like the surface soil when under cultivation. The cotton-plant inclines to run to weed under all circumstances. Guano favors bolling, and causes the cotton to open better. Iron-weed is thick all over this land.

Cotton shipments are made by rail to Fayetteville and Raleigh. Rate of freight per bale, $1 25.

MOORE.

Population: 16,821.—White, 11,485; colored, 5,336.

Area: 807 square miles.—Woodland, 281,934 acres.

Tilled lands: 68,780 acres.—Area planted in cotton, 8,882 acres; in tobacco, 70 acres; in corn, 27,934 acres; in wheat, 11,242 acres; in rye, 1,512 acres; in oats, 7,924 acres.

Cotton production: 3,988 bales; average cotton product per acre, 0.45 bale, 639 pounds seed-cotton, or 213 pounds cotton lint.

Moore county lies on the western margin of the long-leaf pine belt. Its middle and southern portion belongs largely to the class of lands called pine barrens or "sand hills". The northern part of this triangular territory partakes more of the character of the oak uplands agricultural division, being very hilly and broken, with sandy and gravelly soil on the higher ridges, having a mixed oak and pine growth, and on the slopes of the hills partaking of the character of clay loams.

Near the middle (a little north of east), as well as in the southwestern region, and in the eastern one, are considerable bodies of level and rolling upland piny woods. These are the best cotton soils. The tributaries of the Cape Fear, which rise along the southeastern section of the county, are fringed with gum, cypress, and juniper swamps, and on many of the streams, large and small, are patches, and sometimes considerable tracts, of alluvial "bottom" lands. The agriculture of the county is divided between cotton and grain crops; but the lumber and turpentine interests are quite important, and there are yet large turpentine forests untouched.

Of the county area, 13.32 per cent. is tilled land, of which 12.91 per cent. is cultivated in cotton.

ABSTRACT OF THE REPORTS OF J. M. JOY, OF JONESBORO', AND DR. J. C. CAMPBELL, OF CARTHAGE.

The bottoms of Deep river and its tributaries are our most valuable corn soils, and are not cultivated in cotton. They are estimated to form one-twentieth of the whole.

About four-fifths of the land in this region embraces what is termed "*sandy soil*", and extends to the Atlantic coast on the south. The timber is pine, oak, hickory, black-jack, chincapin, and dogwood. The color of the soil varies from a whitish-gray to a yellowish-brown and blackish to the depth of 6 inches, when it changes into that of the subsoil, which in some places is soft sand, in others red or yellow clay. The soil is early, warm, and well drained. The chief crops are corn, cotton, wheat, oats, potatoes, and pease.

The proportion of cotton planted is about one-fifth, and usually grows from 1 to 4 feet in height, 3 feet being the most productive height. It inclines to run to weed when grown on fresh or damp land. Fresh land produces about 600 pounds of seed-cotton per acre, 1,400 pounds making a 475-pound bale of lint, the staple, when clean, rating as middling. After ten years' cultivation the product is 400 pounds per acre, and the staple is shorter than that from fresh land. Crab-grass is the most troublesome. About one-fourth of the land once cultivated now lies turned out. No great damage is done by washing or gullying on the slopes.

Cotton shipments are made by rail to Raleigh at $1 25, and to Fayetteville at 75 cents per bale.

RICHMOND.

Population: 18,245.—White, 8,141; colored, 10,104.

Area: 826 square miles.—Woodland, 216,096 acres.

Tilled lands: 75,268 acres.—Area planted in cotton, 25,198 acres; in corn, 29,502 acres; in wheat, 3,751 acres; in rye, 942 acres; in oats, 3,571 acres.

Cotton production: 12,754 bales; average cotton product per acre, 0.51 bale, 720 pounds seed-cotton, or 240 pounds cotton lint.

Richmond county also lies on the border of the long-leaf pine belt, its eastern and southern portions, forming not less than three-fourths of its territory, belonging to the latter, while its western and northern parts, lying along and near the Great Pedee river, belong more properly in their agricultural features to the zone of oak and pine sandy hills, being quite hilly, and in some places rugged. The slopes of the hills on the river front and its tributaries are quite steep and broken, and have a clay loam soil, which is covered by oak and short-leaf pine forests. In the northwestern corner, on the Pedee and its tributaries, are wide tracts of level gray loam soils, originally covered with heavy oak forests. Through the eastern portion of the county, in a north and south direction, lies a considerable tract of pine barrens, which is very sandy and unproductive. The streams which drain the southeastern section of the county (one-third of its territory) flow into Lumber river, and are margined through their whole course by alluvial tracts and cypress swamps, the divides between these parallel and south-flowing streams being occupied by level upland piny-woods tracts having a gray sandy loam soil of fair productiveness. Cotton is the chief single interest, but the product of grain is large, and the turpentine and lumber interests are still important. Of the county area, 14.24 per cent. is tilled land, of which 33.48 per cent. is cultivated in cotton.

ROBESON.

Population: 23,880.—White, 11,942; colored, 11,938.

Area: 1,039 square miles.—Woodland, 383,093 acres.

Tilled lands: 103,055 acres.—Area planted in cotton, 21,607 acres; in corn, 49,961 acres; in wheat, 875 acres; in rye, 1,548 acres; in oats, 2,814 acres.

Cotton production: 8,846 bales; average cotton product per acre, 0.41 bale, 582 pounds seed-cotton, or 194 pounds cotton lint.

The soils of Robeson county are mainly those of the ordinary level piny woods, but there are belts of gum and cypress swamp along nearly all of its water-courses, those on the two main streams being quite large. The county is drained by the upper waters of Lumber river, which enters the Atlantic through the state of South Carolina at Georgetown. On the higher divides between the streams the soil is sometimes quite sandy, in some places reaching the character of pine barrens. The lands are chiefly devoted to the culture of cotton and corn, but the value of the potato and rice crops is quite considerable. Turpentine and lumber are also large interests. Marl is found abundantly in the lower half of the county. Of the county area, 15.50 per cent. is tilled land, of which 20.96 per cent. is cultivated in cotton. Shipments are made by rail to Wilmington.

BLADEN.

Population: 16,158.—White, 7,598; colored, 8,560.

Area: 1,026 square miles.—Woodland, 297,237 acres.

Tilled lands: 37,990 acres.—Area planted in cotton, 1,618 acres; in corn, 21,556 acres; in wheat, 109 acres; in oats, 362 acres.

Cotton production: 683 bales; average cotton product per acre, 0.42 bale, 603 pounds seed-cotton, or 201 pounds cotton lint.

Bladen county lies south of Cumberland, and, like it, on both sides of the Cape Fear river. It has narrow zones of pine barrens running parallel to the river courses nearly the whole length of the county, and it also abounds in cypress swamps and alluvial "bottoms" along its streams. There are also large bodies of level piny woods. Marl is found in the bluffs of the river. On many of the streams are extensive bodies of gum and cypress swamps. This county has a very limited agriculture, the chief crop being corn; and very little cotton is produced, turpentine and lumber being still among the chief interests. Of the county area, only 5.79 per cent. is tilled land, of which 4.26 per cent. is cultivated in cotton.

ABSTRACT OF THE REPORT OF D. A. LAMONT, OF BRINKLAND.

The upland soils vary greatly in appearance and quality, and may be found in spots and patches of from 1 to 300 acres. Cotton in the lowlands will not mature, and is subject to be killed by frost; therefore the uplands are always preferred.

Three kinds of soils may be distinguished:

(1.) The *gray gravelly soil*, with clay subsoil, forming about one-third of the land in this region. Its natural timber is cypress, oak, poplar, ash, hickory, gum, pine, and walnut. The crops are corn, cotton, and small grain, but the soil is best adapted to cotton, corn, and oats. The cotton crop occupies about one-fourth of the lands, and is most productive when 3 feet high. It is inclined to run to weed in the richest land and in wet seasons, and efforts are made to restrain this tendency by topping and by using less heating manures. The product from fresh land ranges from 1,200 to 1,500 pounds of seed-cotton per acre, 1,425 pounds making a 475-pound bale, which rates in the market as good middling. After three years' cultivation the land yields from 800 to 1,000 pounds per acre, from 1,425 to 1,540 pounds being required to make a bale, which rates as low middling. Rag-weed and hog-weed are most troublesome. About one-third of the land once cultivated now lies turned out, but when it is again taken in it is found to be much improved. The valleys are considerably improved by the washings of the uplands.

(2.) *Chocolate-colored soil*, rich by deposits, occupies one-sixth of the lands in a belt one-half a mile wide by from 12 to 15 miles long. The average thickness is 2 feet before changing into that of the subsoil, which is heavier and sticky. This soil is best adapted to corn, wheat, and oats. Cotton runs to weed under all circumstances.

(3.) *Black soil*, mixed with coarse and fine sand, occupies one-half as much surface, and is about 10 miles long by 2 miles wide. This soil is timbered with pine, bay, black gum, and gallberry. The subsoil contains pipe-clay, and is adapted to corn, potatoes, and cotton; but one-fifteenth of this soil is planted in the latter crop. Fresh land produces from 600 to 1,000 pounds of seed-cotton per acre, which rates in the market as middling.

Cotton shipments are made by steamboat to Wilmington. Rates of freight, per bale, 50 cents.

OAK UPLANDS, OR METAMORPHIC REGION.

(This region embraces the following counties and parts of counties: Warren, Franklin, Granville, Wake, Orange, Chatham, Montgomery, Anson, Union, Stanley, Davidson, Rowan, Cabarrus, Mecklenburg, Iredell, Catawba, Lincoln, Gaston, Cleaveland, Rutherford, Randolph, Guilford, Alamance, Person, Caswell, Rockingham, Stokes, Forsyth, Davie, Yadkin, Surry, Wilkes, Alexander, Caldwell, Burke, McDowell, and Polk.)

WARREN.

Population: 22,619.—White, 6,386; colored, 16,233.
Area: 507 square miles.—Woodland, 140,528 acres.
Tilled lands: 83,864 acres; area planted in cotton, 21,603 acres; in tobacco, 1,759 acres; in corn, 28,457 acres; in wheat, 5,098 acres; in oats, 5,559 acres.
Cotton production: 7,778 bales; average cotton product per acre, 0.36 bale, 513 pounds seed-cotton, or 171 pounds cotton lint.

Warren county lies on the northern border of the state, and is bounded in part by the Roanoke river, the tributaries of which drain about one-half of its territory, the southern half being drained by the Tar river. Through the middle of the county, along the divide between these rivers, lies a wide, level, and undulating tract, with forests of oak and short-leaf pine, hickory, dogwood, etc., having generally a soil of the class of gray and yellowish gravelly and sandy loam, and frequently belts of red-clay loam. Northward and southward the land becomes more hilly, and near the streams the soil is more clayey and often reddish in color. Many of these streams are bordered by narrow strips of level bottom land. The tributaries of the Tar on the southern side are separated by wide tracts of nearly level oak uplands, and are bordered by extensive bottoms. This portion of the county is also less broken than the northern. The agriculture of the county is divided between the production of cotton, tobacco, and the cereals; but the vine and the peach flourish, especially in the northern and western sections lying within the hill country. The western border of the county rises to an elevation of 500 feet, so that there is abundant water-power developed by the fall of its numerous streams, many of which leave its territory at an elevation of less than 200 feet. Gold mining has been a profitable industry in the southern corner of the county and the neighboring parts of Halifax, Nash, and Franklin.

Of the county area, 25.84 per cent. is tilled land, of which 25.76 per cent. is cultivated in cotton. Transportation to market is furnished by railroad to Raleigh, Norfolk, and New York.

FRANKLIN.

Population: 20,829.—White, 9,476; colored, 11,353.
Area: 526 square miles.—Woodland, 146,604 acres.
Tilled lands: 87,492 acres.—Area planted in cotton, 30,274 acres; in tobacco, 118 acres; in corn, 32,642 acres; in wheat, 8,362 acres; in oats, 5,560 acres.
Cotton production: 12,938 bales; average cotton product per acre, 0.43 bale, 609 pounds seed-cotton, or 203 pounds cotton lint.

Franklin county lies south of Warren, and corresponds very nearly in all its agricultural and topographical features with the description of that county. The eastern, and especially the southeastern sections contain a considerable proportion of long-leaf pine as a constituent of the forests. This county is drained by the Tar river and its tributaries. The middle portion belongs to the region of oak and pine gravelly and sandy hills, and the western end rises into the oak uplands. The large cotton product of this county is of recent date, but here and in the adjoining counties it has greatly increased in the last dozen years. The western half is largely devoted to the culture of tobacco. Of the county area, 25.99 per cent. is tilled land, of which 34.60 per cent. is cultivated in cotton.

ABSTRACT OF THE REPORT OF BLAIR BURWELL, OF LOUISBURG.

The kinds of soils cultivated in cotton are as follows: (1) Sandy soil, with yellow-clay subsoil; (2) sandy soil, with red-clay subsoil; (3) black sandy soil, with close black subsoil.

The chief soil is the *sandy*, which forms about two-thirds of the land in this region, and is the leading soil in the county, with now and then soil No. 2 in the northern part of the county and occasionally soil No. 3 in the east and south. Its chief natural timber is short-leaf pine, with some long-leaf pine in the southeast. The average thickness of the surface soil before its color changes is from 3 to 6 inches. Cotton and corn are the chief crops, but the soil seems best adapted to cotton, which occupies about one-third of the cultivated acreage. The plant is most productive at 2½ feet, but reaches from 1½ to 3½ feet. Wet weather in June or July makes it run to weed, and topping succeeds partially in making it boll. Fresh land produces 500 pounds of seed-cotton per acre, 1,425 pounds making a 475-pound bale, which, when clean, rates in the market as middling. After three years' cultivation the yield is from 400 to 600 pounds per acre, and 1,425 pounds make a bale, which rates the same as the fresh. Wire- and crab-grass are most troublesome. About one-third of the land originally cultivated now lies turned out, but when again taken in it produces a fair yield. It gullies readily on the slopes, but no serious damage is done. The valleys are often injured by the washings of the uplands, and efforts have been made, with fair success, to check the damage by horizontalizing.

Cotton shipments are made by rail to Norfolk and Raleigh, and the rates of freight per bale are to Norfolk $2 25, and to Raleigh 75 cents.

GRANVILLE.

Population: 31,286.—White, 13,603; colored, 17,683.
Area: 695 square miles.—Woodland, 161,089 acres.
Tilled lands: 145,036 acres.—Area planted in cotton, 6,559 acres; in tobacco, 8,941 acres; in corn, 42,608 acres; in wheat, 14,428 acres; in oats, 14,344 acres.
Cotton production: 2,535 bales; average cotton product per acre, 0.39 bale, 552 pounds seed-cotton, or 184 pounds cotton lint.

Granville county lies on the Virginia border west of the two preceding counties, and is drained partly toward the north by the tributaries of the Roanoke and partly (in its middle region) by the Tar, and in its southern portions by the Neuse. In its central and higher portions, where it is 500 feet above tide, it is comparatively level and rolling, and has, for the most part, a gray gravelly loam soil, with here and there small tracts of red clay. Among the most productive soils is a level body of oak and hickory land in the northern section with a dark gravelly-loam soil. Smaller tracts of similar character occur near the middle, and also on the southern border. The southern portion of the county, along the divide between the waters of the Tar and Neuse rivers, is another comparatively level bench of land, belonging mainly to the class of gray sandy loams, derived in large part from the underlying Triassic rocks (red sandstone). These alternate with gray gravelly loams. The forests are of oaks, hickory, and dogwood, intermingled with short-leaf pine. The principal agricultural product of this county is the gold-leaf tobacco, which is the largest crop in the state—more than 4,500,000 pounds.

The gray and light-colored granite soils of the eastern, middle, and western sections, as well as the last-named (Triassic) soils, are noted for the high grade of tobacco which they produce. This is also a large grain-growing county, its aggregate reaching nearly 750,000 bushels. Of the county area 32.61 per cent. is under tillage, of which 4.52 per cent. is cultivated in cotton.

ABSTRACT OF THE REPORTS OF J. W. HUNTER, OF KITTRELL, AND S. P. J. HARRIS, OF HENDERSON.

The uplands are rolling, partly sandy and partly mulatto, and the soil is generally uniform, with no great change of soil or surface in the southern part. The springs are generally late and frosts early. The former prevents planting as early as we would like, and the latter often cuts off the yield sometimes as much as 25 per cent.; but otherwise our climate is good for the growth of cotton.

The soils cultivated in cotton are, first, a light sandy and gravelly soil; second, mulatto and red lands; and third, a red, stiff clay. The chief soil is the *sandy soil*, about one-half of the lands being of this kind. Its natural timber is pine, oak, hickory, gum, and black-jack. The soil varies from a fine sandy to a gravelly loam of a gray color, and has a depth of 6 inches. The subsoil is mostly a red, firm clay, which mixes well with the surface when plowed deeply. The chief crops are tobacco, cotton, wheat, and oats, but the soil is apparently best adapted to the production of tobacco and wheat.

In the year 1869 one-half of the land was in cotton, but in 1879 only one-eighth. The plant generally attains a height of 3 feet, but is most productive when 2 feet high. It tends to run to weed in very wet seasons, and topping is resorted to as a preventive. Fresh-land staple rates in the market as middling. The most troublesome weeds are crab-grass, hog-weed, and water-weed. Perhaps about one-fourth of such land now lies turned out, and these are now the most valuable for bright tobacco; but when again taken into cultivation it will do finely.

The *mulatto or light-red land* constitutes but a small proportion of the land in this region. Its color is a brown mahogany, and it has a red-clay subsoil, underlaid at 2 feet by rock. The *red stiff and pipe clay*, extending chiefly around Oxford, is timbered with oak, hickory, and black-jack, and is best adapted to tobacco, wheat, and grapes.

Cotton shipments are made by railroad to Norfolk and Raleigh. Rates of freight per bale are: to Norfolk, $2 65; to Raleigh, $1 25.

WAKE.

Population: 47,939.—White, 24,289; colored, 23,650.
Area: 932 square miles.—Woodland, 240,004 acres.
Tilled lands: 156,899 acres.—Area planted in cotton, 59,916 acres; in tobacco, 230 acres; in corn, 53,172 acres; in wheat, 14,783 acres; in rye, 211 acres; in oats, 13,948 acres.
Cotton production: 30,115 bales; average cotton product per acre, 0.50 bale, 717 pounds seed-cotton, or 239 pounds cotton lint.

Wake county, in which the capital of the state is situated, is one of the largest counties in the state, and shows the largest product of cotton. It is drained by the tributaries of the Neuse, and lies on the eastern margin of the oak uplands, its southern and eastern sections partaking of the agricultural features of the oak and pine gravelly hills, the forests being made up of long-leaf and short-leaf pines, oaks, hickories, dogwoods, etc. The northern portion of the county, as well as the western, is quite hilly and broken in surface, especially along the streams, and the soils are predominantly gray and yellow sandy and gravelly loams, with occasional areas of red-clay soils. Cotton is the chief crop of the county, but the northwestern section adds to this industry the production of tobacco. The culture of corn is also a large feature in its agriculture, and in this crop Wake also stands first, exceeding 600,000 bushels, which, with the small grains added, would nearly reach 800,000 bushels. In elevation and surface features Wake resembles the counties last described, the levels ranging between 300 and 500 feet above the sea.

The product of cotton has greatly increased in this county (more than fourfold), as well as throughout this region and the state, in the last decade, and the fact is mainly due here, as elsewhere, to the increased consumption of commercial fertilizers. Of the county area, 26.30 per cent. is tilled land, of which 38.19 per cent. is cultivated in cotton.

ABSTRACT OF THE REPORT OF O. W. SHAFFER, OF RALEIGH.

The kinds of soils cultivated in cotton are: (1) mulatto or chocolate land, a very deep red clayey loam; (2) sandy soil and sandy loam, light and easy to till, but not rich; (3) clay with sand and mica. The chief soil is the "*mulatto lands*", and the proportion of lands of this kind in this region is very small, say 1 in 50, but is much greater in other townships. Its timber is pine, oak, poplar, maple, elm, hickory,

cedar, sweet and black gum, and dogwood. The soil is a heavy clay loam, which grows darker with cultivation and manure. The leading crops are cotton, corn, oats, wheat, cow-pease, etc. That portion planted in cotton forms at least one-half of all the lands in cultivation, and attains a height of from 3 to 3½ feet, the latter being most productive if the season is favorable and long; but it inclines to run to weed in warm, wet weather and on very rich land.

Fresh land produces 800 pounds of seed-cotton per acre, 1,425 pounds being needed for a bale, which, when clean, rates in the market as middling. After six years' cultivation the production is from 400 to 500 pounds per acre, from 1,425 to 1,660 pounds being needed for a bale, and the staple is shorter and lighter than that from fresh land. June grass is most troublesome. The valleys are injured by the washings of the uplands, and efforts are made to check the damage by hillside surface ditches, with very good success.

The *light sandy loam* occupies two-thirds of the lands, three-fourths of which is planted in cotton. This soil, which extends all over the county, is sometimes underlaid with a clay subsoil at from 3 to 8 inches, and can be properly described as a whitish gray to brown fine sandy loam. Its natural timber is pine, poplar, maple, scrub oaks, elm, and gum. The subsoil is heavier than the surface soil, and is a clay mixed with sand; it is best adapted to cotton and pease. Cotton grows to a height of from 2 to 2½ feet, the larger being the more productive in good seasons. Fresh land produces 400 pounds of seed-cotton per acre, and 1,660 pounds make a bale, which rates as middling.

The *clay lands* extend throughout the county in patches, and the timber is the same as that of soil No. 1. The color varies almost indefinitely. The average thickness of the surface soil is from 4 to 6 inches.

Cotton shipments are made by wagon to Raleigh.

ORANGE.

Population: 23,698.—White, 14,555; colored, 9,143.

Area: 652 square miles.—Woodland, 130,549 acres.

Tilled lands: 82,667 acres.—Area planted in cotton, 5,290 acres; in tobacco, 2,323 acres; in corn, 28,542 acres; in wheat, 18,358 acres; in oats, 12,243 acres.

Cotton production: 1,919 bales; average cotton product per acre, 0.36 bale, 516 pounds seed-cotton, or 172 pounds cotton lint.

Cotton is beginning to enter largely into the agricultural interests of Orange county, and the product now is five times as large as it was in 1870. The upper half of this county is devoted, in large part, to the culture of tobacco, and the whole of it to the production of grain crops, of which the aggregate exceeds 550,000 bushels. It is traversed in a northeast and southwest direction through its middle region by chains of slate hills. Its levels lie between 400 and 800 feet above sea-level, the average elevation being about that of the state, viz, 640 feet. Its southeastern section is drained by the tributaries of the Cape Fear river, and has a low, undulating tract of land, with gray and yellow sandy and clay loam soils and mixed oak and pine forests. The larger part of this county is characterized by oak forests and red-clay soils, with an intermixture in the poorer sections and on the slaty hills of short-leaf pine. The region described as slate hills is characterized mainly by a gray gravelly loam soil. Of the county area, 19.81 per cent. is under tillage, of which 6.40 per cent. is devoted to cotton. The university is located in this county.

ABSTRACT OF THE REPORT OF C. W. JOHNSTON, OF CHAPEL HILL.

The principal soil is sandy, and occupies one-fourth of the lands of this county with an average thickness of 5 inches. The growth is oak and hickory. The chief crops are corn, wheat, and oats. The proportion of cotton planted is not more than one-sixth; its usual height is 3 feet, and it produces best at 2½ feet, but runs to weed from too much wet. The product of seed-cotton on fresh land is from 600 to 800 pounds, and 1,660 pounds make a bale. Crab-grass is the most troublesome pest. About one-half of such land originally cultivated lies turned out, but when taken into cultivation it produces well if manured. This land does not easily wash.

Shipments are made by rail to Raleigh.

CHATHAM.

Population: 23,453.—White, 15,500; colored, 7,953.

Area: 826 square miles.—Woodland, 212,212 acres.

Tilled lands: 119,185 acres.—Area planted in cotton, 13,478 acres; in tobacco, 141 acres; in corn, 43,087 acres; in wheat, 28,930 acres; in oats, 19,861 acres.

Cotton production: 5,858 bales; average cotton product per acre, 0.43 bale, 618 pounds seed-cotton, or 206 pounds cotton lint.

Chatham county lies contiguous to the long-leaf pine belt, and includes a small strip of it along the southern edge. It is drained by the waters of the Cape Fear river, the main affluents of which unite near its southeast corner. The principal of these, Deep river, has on both sides extensive bottom lands, covered with oak and short-leaf pine forests, which are very productive. A large part of its surface is hilly and broken, especially near the rivers, and in the middle and northeastern sections these hills rise to an elevation of from 660 to 700 feet above the sea, attaining in a few cases the elevation and designation of small mountains; the average elevation is 500 feet. The soils are for the most part those of the oak uplands, generally sandy, gray to yellow loams, alternating here and there with belts of red-clay soil. Toward the southern borders occur the sandy and gravelly oak and pine hills. With the exceptions noted, the forests consist mostly of oak, hickory, etc. Along the eastern margin of the county is a wide, level tract of oak and pine lands, with a gray clay loam soil of Triassic origin. Only a minor portion of Chatham, in the southern and eastern parts, is devoted to the culture of cotton, grain crops constituting its predominant agricultural interest. Its corn product exceeds 550,000 bushels, and the total grain crop exceeds 800,000 bushels. Its facilities for manufacturing are unsurpassed. Two large and two other considerable rivers cross its territory with a fall of from 300 to 400 feet, and develop a force of more than 40,000 horse-power. Of the county area, 22.55 per cent. is tilled land, of which 11.30 per cent. is cultivated in cotton.

Facilities for transportation are ample, both by railway and river.

ABSTRACT OF THE REPORT OF R. J. POWELL, OF PITTSBORO'.

East of the Haw river the lands are generally sandy, with some red clay. West of the river the gray, gravelly lands are suited best for cotton; there is but little sandy land on the west side. Cotton matures much better where there is sand in the soil, and is rarely planted in lowlands. In damp locations it is subject to rust; hence the entire cotton crop is raised on rolling land. The stiff red-clay soil produces a huge growth of stalk, but it continues green till checked by frost, and does not mature the fruit; at least one-third of the cotton fruit on such soil never matures.

The dark sandy loam east of the Haw river extends to the Orange and Wake county-lines, covering about one-third of the county, and the river is the dividing line between the stiff clay and sandy loam lands. The timber is oaks, hickory, dogwood, and pine. The soil is a whitish-gray and blackish, fine sandy and coarse sandy and gravelly loam, having a thickness of from 3 to 6 inches, and a subsoil of tough red and yellow clay. The chief crops are cotton on the east side and cereals and grass on the west side of the Haw river. Cotton usually attains a height of from 2 to 5 feet, but is most productive when from 3 to 3½ feet high. It is inclined to run to weed when too thick in the drill in very wet seasons, and thinning and topping restrain it and favor bolling. Fresh land produces (without fertilizers) 400 pounds of seed-cotton per acre, and 1,425 pounds will make a 475-pound bale, which, when clean, rates as middling in the market. After three years' cultivation the product is 150 pounds per acre, 1,545 pounds making a bale, but the staple does not rate as good as that from fresh land. Crab-grass is the most troublesome weed. About one-fourth of the land once in cultivation now lies turned out. Old-field pines and cedars reclaim our lands very fast when not so rolling as to wash away, and in a few years they produce as well as ever.

Cotton shipments are made in October, by wagon, to Raleigh.

The report of Mr. J. F. Rives, of Pedlar's Hill, agrees in the main with the above. He mentions, however, among the chief crops, besides cotton and corn, sorghum, wheat, oats, and potatoes, and among the troublesome weeds Spanish needles and hog-weed. He considers shallow cultivation favorable to bolling.

Mr. J. W. Scott describes one-half the lands in his township—Haywood, about the forks of Cape Fear river—as a sandy, gravelly loam, having a growth of short-leaf pine, oaks, hickory, gum, poplar, elm, etc., about one-quarter of which is planted in cotton. The chief crops are cotton, corn, wheat, oats, pease, sorghum, peanuts, and tobacco. Cotton reaches a height of from 3 to 6 feet, and runs to weed in wet summers on rich clay soils, but is restrained by early topping. The product of seed-cotton per acre on fresh land is from 600 to 1,200 pounds, from 1,425 to 1,545 pounds making a bale of lint, early pickings grading as middling. After 3 or 5 years the yield is from 300 to 500 pounds per acre, the same amount being required for a bale, and the staple being as good as that from fresh land.

MONTGOMERY.

Population: 9,374.—White, 6,857; colored, 2,517.

Area: 489 square miles.—Woodland, 179,473 acres.

Tilled lands: 46,209 acres.—Area planted in cotton, 6,519 acres; in tobacco, 54 acres; in corn, 18,090 acres; in wheat, 9,197 acres; in oats, 7,852 acres.

Cotton production: 2,989 bales; average cotton product per acre, 0.46 bale, 654 pounds seed-cotton, or 218 pounds cotton lint.

In its topographical features Montgomery county may be described in nearly the same terms as the Chatham. Several low chains of mountains or high ranges of slate hills cross its territory in a direction nearly north and south. The county is drained by the Yadkin river and two of its chief tributaries, the Uharie and Little rivers. Its territory, therefore, is quite broken in surface. Its soils are mostly sandy and gravelly loams, with occasional tracts of red clays. Along its eastern border, and particularly in its southeastern corner, there are large bodies of valuable timber, as it here touches the long-leaf pine belt; the lands are of the common character of this border region, and its soils are generally lean. Cotton is quite a subordinate interest in comparison with grains. Of the county area, 14.77 per cent. is tilled land, of which 14.11 per cent. is cultivated in cotton. The water-power of its rivers is very great, the Yadkin having a fall within the county of more than 200 feet and a force per foot of above 350 horse-power. There are many valuable gold mines, both vein and placer.

ANSON.

Population: 17,994.—White, 8,790; colored, 9,204.

Area: 545 square miles.—Woodland, 149,000 acres.

Tilled lands: 88,293 acres.—Area planted in cotton, 28,296 acres; in corn, 29,121 acres; in wheat, 5,969 acres; in oats, 8,799 acres.

Cotton production: 11,857 bales; average cotton product per acre, 0.42 bale, 597 pounds seed-cotton, or 199 pounds cotton lint.

Anson county lies on the southern border of the state, and is bounded on the east by the Pedee river. About one-third of its territory, in the southeastern portion, belongs to the long-leaf pine belt, with its characteristic soils and forests. The northwestern and northern sections of the county consist of slate soils (gray, gravelly clays), occupied by forests of oak, short-leaf pine, hickory, dogwood, etc. The river hills near the Pedee have a sandy and gravelly loam, becoming more red and clayey on the lower slopes. There lies across the middle, in a northeast and southwest direction, a low, nearly level tract, 5 or 6 miles wide, of brown, yellow, and gray sandy and clay loam soils, derived from the clays and sandstones of the Trias. These lands are naturally quite productive, but are much worn, and have been devoted mainly to the culture of cotton, which is the most important industry of the county, although the corn crops are quite large. Of the county area, 25.31 per cent. is under tillage, of which 32.05 per cent. is in cotton.

ABSTRACT OF THE REPORT OF W. A. LILES, OF WADESBORO'.

The chief soil cultivated in cotton is a *sandy soil*, which occupies three-fifths of the lands in the region, and is whitish gray and brown in color. Its timber is pine, oak, hickory, black-jack, and dogwood. The thickness of the surface soil on uplands is 4 inches; on river or creek bottoms from 2 to 5 feet. The subsoil is a purple and red clay, quite impervious, and yellow porous clay.

The chief crops are cotton, corn, oats, and wheat. The soil is best adapted to oats; but the proportion of cotton planted comprises two-fifths of the cultivated lands, and attains a height of from 2 to 5 feet, but is most productive at 3 feet. In warm, wet weather and rich bottom lands it is inclined to run to weed, and fertilizing favors bolling.

Fresh land produces 800 pounds of seed-cotton per acre, and 1,425 pounds will make a bale. After ten years' cultivation the product is 500 pounds per acre, and 1,425 pounds make a bale, which compares favorably with the staple from fresh land. Crab-grass is the most troublesome weed. About one-fourth of the land once in cultivation now lies turned out. The soil on the slopes readily washes or gullies, and the valleys are injured by the washings from the uplands, often seriously.

The *bottom lands*, of which one-fifth is cultivated in cotton, is buff, yellow, brown, or mahogany in color, and is late, cold, ill-drained, and best adapted to corn. Its natural timber is oak, gums, poplar, and hickory. The cotton-plant grows from 4 to 6 feet in height, and is apt to run to weed in warm, damp weather; phosphate manure favors bolling. Fresh land produces 1,500 pounds of seed-cotton per acre, and 1,485 pounds will make a 475-pound bale. After ten years' cultivation the product is 1,000 pounds per acre, 1,425 pounds making a bale, and the staple compares favorably with that from fresh land. About one-twentieth of the land once in cultivation now lies turned out, but when again taken in it does well.

The *slaty soil*, of which one-fourth is planted in cotton, occupies about three-tenths of all the land in this region, but the soil is best adapted to wheat and oats. Its natural timber is pine and post oak. The height attained by cotton on this land is 2 feet. The production on fresh land is 500 pounds of seed-cotton per acre; after ten years' cultivation, 300 pounds per acre. About one-third of such land once cultivated now lies turned out, and when again taken in it does poorly.

Cotton shipments are made all the season by rail to Wilmington and Charleston; rates of freight per bale, $1 60

UNION.

Population: 18,056.—White, 13,520; colored, 4,536.
Area: 557 square miles.—Woodland, 176,245 acres.
Tilled lands: 83,913 acres.—Area planted in cotton, 19,090 acres; in corn, 28,877 acres; in wheat, 12,464 acres; in oats, 14,357 acres.
Cotton production: 8,336 bales; average cotton product per acre, 0.44 bale, 621 pounds seed-cotton, or 207 pounds cotton lint.

The southern portion of Union county, which lies on the South Carolina border, is penetrated to a distance of several miles by sinuses of long-leaf pine (sandy lands) on the level-backed divides between the streams. This portion of the county is drained southward into the Pedee through South Carolina.

The soils of the larger part of the county are of a slaty origin, and are gray gravelly and sandy for the most part, with occasional areas of red clays. The forests are mixed pine and oak, hickory, etc. The soils of a narrow belt along the west side are granitic. The cotton product belongs mainly to the southern half, the northern portion being devoted to small grains, of which it produces large crops—a total of nearly 500,000 bushels.

Of the county area, 23.54 per cent. is tilled land, of which 22.75 per cent. is cultivated in cotton.

ABSTRACT OF THE REPORT OF H. M. HOUSTON, OF MONROE.

The upland soils vary greatly. The soil chiefly cultivated in cotton is the *mulatto (black-jack) soil*, which occupies one-third of the lands in this region, extending in patches through the county in a direction northeast by southwest, and is timbered with pine, Spanish oak, and black-jack. Three-fourths of this soil is planted in cotton. The average thickness of the surface soil is 2 feet, when it changes into the subsoil, which is a tough, dark-red clay. The chief crops are cotton, corn, wheat, and oats, but the soil is best adapted to cotton, which usually attains a height of 3 feet, and will run to weed in wet, warm weather, topping and fertilizers being used to restrain this tendency. Fresh land produces 1,200 pounds of seed-cotton per acre, 1,425 pounds being needed to make a bale of lint, the staple rating as strict good middling. After ten years' cultivation the product is very little less, and the staple rates the same. Hog-weed is most troublesome. One-fourth of the land once cultivated now lies turned out. Considerable damage is done by wash or gullies on the slopes, and efforts have been made to check this by hillside ditching with good success.

Black slate gravel soil also occupies about one-third of the lands in patches of from 5 to 100 acres, and is timbered with pine, hickory, and oak. The thickness of the surface soil is from 6 to 12 inches, and has a subsoil of red clay, underlaid by a blue slate rock. The soil is best adapted to cotton, and one-fourth of it is planted in this crop. Fresh land produces from 600 to 800 pounds of seed-cotton per acre, 1,425 pounds making a 475-pound bale of lint, which, when clean, rates as good strict middling. After ten years' cultivation the product ranges from 400 to 600 pounds of seed-cotton per acre. About one-fifth of land once cultivated now lies turned out; but when again taken in it does well the first year in wheat and the second year in cotton.

The *sandy soil* occupies one-third of the lands in this region, running through the county northeast and southwest in streaks, two-thirds being planted in cotton. The natural timber is pine, hickory, and black-jack.

Cotton shipments are made in October, November, and December, by rail, to Wilmington, Norfolk, New York, and Providence at $2 25 per bale.

STANLEY.

Population: 10,505.—White, 9,166; colored, 1,339.
Area: 432 square miles.—Woodland, 119,148 acres.
Tilled lands: 58,628 acres.—Area planted in cotton, 5,878 acres; in corn, 22,426 acres; in wheat, 16,465 acres; in oats, 10,975 acres.
Cotton production: 2,475 bales; average cotton product per acre, 0.42 bale, 600 pounds seed-cotton, or 200 pounds cotton lint.

Stanley county lies on the west side of the Yadkin river, and is bounded on the south by the Rocky river, one of its largest tributaries. Its soils are derived from the clay and chlorite slates of the great central slate belt of the state, and are gray and gravelly loams or red clays, according as the underlying rock is of the former or of the latter description. The forests are of oak and short-leaf pine. Its surface is quite broken near the rivers. The southwestern corner of the county is characterized by broad and comparatively level tracts of gravelly land, covered with extensive short-leaf pine forests, with a subordinate growth of oaks. The cotton product is of about equal value with that of the grains, of which the total exceeds 400,000 bushels. The slate lands of this region produce heavier wheat than any other soils, reaching 65 and even 70 pounds to the bushel. Of the county area, 21.21 per cent. is tilled land, of which 10.02 per cent. is cultivated in cotton.

Transportation is by wagon to railroads of the adjacent counties.

DAVIDSON.

Population: 20,333.—White, 16,341; colored, 3,992.

Area: 564 square miles.—Woodland, 142,673 acres.

Tilled lands: 113,314 acres.—Area planted in cotton, 3,779 acres; in tobacco, 484 acres; in corn, 36,983 acres; in wheat, 32,195 acres; in oats, 16,924 acres.

Cotton production: 1,553 bales; average cotton product per acre, 0.41 bale, 585 pounds seed-cotton, or 195 pounds cotton lint.

This county lies midway of the breadth of the state and of the midland division, and on the northern border of the cotton belt. The average elevation is about 800 feet above sea-level—the northern end 1,000 and the southwestern 600 feet—but is interrupted by ranges of hills which are 900 feet in height and upward. The county is bounded on the west by the tortuous course of the Yadkin river, whose numerous tributaries drain almost its entire surface, one of which, Abbott's creek, traverses its middle section from north to south, while a multitude of smaller streams flow in a generally southwest course into the river. Both the river itself and these tributaries are generally bordered by tracts of bottom lands with a rich alluvial soil, covered by heavy forests of oak, largely white oak. There are considerable tracts of red-clay soil scattered through various portions of the county, which are covered with heavy oak forests. The eastern and northern margins, which lie along the elevated divides and swells between the greater rivers, contain mixed oak and pine forests, and have a soil which is generally a gray and yellow gravelly or sandy loam. A clay subsoil is found throughout the county. The cotton product of Davidson county is small, and is limited to its southern end. Its wheat crop is the largest in the state, and its total grain product is only less than that of Rowan, amounting to 850,000 bushels. The southern half of the county lies within the great gold belt, and numerous mines of gold, and quite a number of copper and silver, have been opened. The slate hills of the south end are notable for their deposits of gold gravel, or placers. Of the county area, 31.39 per cent. is tilled land, of which only 3.33 per cent. is cultivated in cotton.

Transportation is by rail to Charleston, Norfolk, and New York.

ROWAN.

Population: 19,965.—White, 13,621; colored, 6,344.

Area: 482 square miles.—Woodland, 117,870 acres.

Tilled lands: 94,378 acres.—Area planted in cotton, 10,645 acres; in tobacco, 216 acres; in corn, 38,963 acres; in wheat, 24,195 acres; in rye, 253 acres; in oats, 17,751 acres.

Cotton production: 4,381 bales; average cotton product per acre, 0.41 bale, 585 pounds seed-cotton, or 195 pounds cotton lint.

Rowan county lies on the west bank of the Yadkin river and south of its principal tributary, the South Yadkin, and resembles very closely in its agricultural and topographical features the county of Davidson, above described. Its entire surface is drained by the tributaries of the Yadkin, which traverse its territory in a northeasterly course. Its middle and northern sections, which lie for the most part above the level of 800 feet, rising at one point above 1,000 feet, are characterized by an abundance of red-clay soils and heavy oak forests, interspersed with hickory, walnut, etc., only the higher parts of the water-sheds between the streams showing any growth of pine (short-leaf), and having gray and yellow sandy loam soils. The southeastern corner of the county, amounting to one-third of its territory, is quite broken, and is traversed by low ranges of mountains or high hills, which rise in places to a level of a thousand feet and more above the sea. These consist geologically, for the most part, of ledges of granite. The hills of this region have a light gray and yellow sandy loam soil.

The culture of cotton has greatly increased in the past decade, but still occupies a secondary place in the agriculture of the county, most of its territory being better adapted to the growth of corn and small grains, of which the total is the largest in the state, being more than 875,000 bushels. The upper portion produces also a considerable quantity of tobacco. Of the county area, 30.59 per cent. is tilled land, of which 12.34 per cent. is cultivated in cotton. There are many gold mines in this county, mostly in the southern part, and several copper veins.

ABSTRACT OF THE REPORT OF J. G. RAMSAY, OF SCOTCH IRELAND.

The kinds of soil cultivated in cotton are the red clay and sandy soils, and most of the planting is done in a mixture of these soils when practicable. About one-third of the lands in this region are *sandy*, and the natural growth is pine, oak, hickory, ash, elm, maple, walnut, dogwood, black-jack, sweet and black gum, and sourwood. The average thickness of the surface soil is 6 inches, and it is difficult to till in dry seasons. The principal crops are corn, wheat, oats, rye, cotton, and tobacco, but the soil is best adapted to wheat, corn, and oats. About one-twentieth of the tilled land is planted in cotton, which usually grows to a height of 3 feet, and if higher is not so productive. It inclines to run to weed on rich, wet land, not fertilized. Fresh land produces from 500 to 600 pounds of seed-cotton per acre, 1,425 pounds making a bale of lint, the staple rating, when clean, about second rate. Crab-grass is most troublesome. Serious damage is done by washing or gullies on the slopes.

Cotton shipments are made in October, November, December, and January, by rail, to Salisbury at 50 cents per bale.

CABARRUS.

Population: 14,964.—White, 9,849; colored, 5,115.
Area: 370 square miles.—Woodland, 86,297 acres.
Tilled lands: 80,439 acres.—Area planted in cotton, 19,224 acres; in corn, 26,831 acres; in wheat, 17,550 acres; in oats, 7,592 acres.
Cotton production: 7,467 bales; average cotton product per acre, 0.39 bale, 552 pounds seed-cotton, or 184 pounds cotton lint.

Cabarrus resembles Rowan county in its general features, both topographical and agricultural. It is drained by the upper waters of the Rocky river, one of the chief affluents of the Yadkin, and abounds in water-courses, which traverse its territory from northwest to southeast, dividing it into narrow zones or flattish swells, the higher parts of which are comparatively level and are covered with a growth of oaks and pines and have a characteristic gray to yellow loam soil, while along the borders of the streams there are numerous and often extensive tracts of alluvial bottom lands, which, as well as large tracts of red clay and dark gravelly loam soils, are covered with heavy forests of oak, hickory, walnut, poplar, maple, etc. Along the eastern margin of the county lies a narrow belt of a few miles in breadth of slate hill-land, in the forests of which the short-leaf pine predominates. The soils of this tract are much less productive than the average of the county. Cotton enters as a large element into the agriculture of this county, and divides almost equally the attention of its population with grain crops, of which it produces more than half a million bushels. Of the county area, 33.97 per cent is tilled land, of which 23.90 per cent. is cultivated in cotton. Gold and copper mining also come in for a considerable share of attention.

ABSTRACT OF THE REPORT OF JOHN M'DONALD, OF CONCORD.

The upland soil greatly varies, and there is no continuous extent of any one variety. No lowlands in this region are cultivated in cotton. The best cotton lands consist of a more or less *fine granitic soil.* This soil is of a loose, loamy character, and is easily worked. About 20 per cent. of the land of the county is of this character, and is found in all parts of it in limited areas. Its natural timber growth is hickory, the various oaks, some walnut, short-leaf pine, etc. The soil is a whitish-gray fine sandy loam to the depth of 6 inches, with a subsoil of stiff red and sometimes yellow clay, not altogether impervious.

The chief crops are cotton, corn, wheat, and oats, and the soil is well adapted to all of these on the uplands, while on the lowlands it is best adapted to corn. The proportion of cotton planted comprises two-thirds of the cultivated lands. It is most productive when 3 feet high, and is inclined to run to weed in wet seasons or in a wet spell preceded by a drought, but this tendency is restrained by deep cultivation and underdraining by thoroughly subsoiling. Fresh lands produce 1,000 pounds of seed-cotton per acre, and 1,425 pounds will make a 475-pound bale of lint, which rates in the market as good middling. After five years' cultivation the product ranges from 500 to 700 pounds per acre, about the same amount of seed-cotton being needed for a bale; but there is no difference in the staple. Crab-grass and butter-weed are the most troublesome pests. About 20 per cent. of the land once in cultivation now lies turned out; it improves by this, and if kept from washing and the old field pine allowed to grow up the yield will nearly equal that of fresh land. Very little is done to prevent washing on the slopes, except by hillside ditching, which, if intelligently done, proves effective.

The *stiff mulatto-colored soil* is probably the result of the decomposition of the same kind of rock as the granite soils, but with a larger percentage of clay; consequently, it does not wash so easily, and is more retentive of plant-food, but not so easy to work. About 25 per cent. of the land in this region is of this kind, one-fourth being planted in cotton. The surface soil is a heavy clay loam of a mahogany color to the depth of 12 inches, with a subsoil of deep red clay; it is best adapted to wheat, cotton, and corn. Fresh land produces from 900 to 1,000 pounds of seed-cotton per acre, 1,425 pounds making a bale, which, when clean, rates in the market as middling. After five years' cultivation the product is about 500 pounds per acre.

The *heavy black soil,* with pipe-clay subsoil, commonly called *black-jack land,* occupies about 20 per cent. of the land in this region, and is timbered with black-jack. This soil seems best adapted to corn and wheat. The proportion of cotton planted is one-half, and the product from fresh land is 800 pounds of seed-cotton per acre; the lint rates as middling. Cotton shipments are made to Concord and Charlotte; the rates of freight are 60 cents per hundred-weight.

MECKLENBURG.

Population: 34,175.—White, 17,922; colored, 16,253.
Area: 576 square miles.—Woodland, 115,649 acres.
Tilled lands: 134,028 acres.—Area planted in cotton, 41,343 acres; in corn, 41,285 acres; in wheat, 12,295 acres; in oats, 12,949 acres.
Cotton production: 19,129 bales; average cotton product per acre, 0.46 bale, 660 pounds seed-cotton, or 220 pounds cotton lint.

Mecklenburg county lies on the southern border of the state, and is bounded westward by the Catawba river. The elevation varies between 600 and 900 feet, the average being about 700 above the sea. This is one of the largest and most productive as well as one of the most populous counties in the state. The production of cotton constitutes the principal feature of the agriculture of the entire county, having increased more than threefold in the last ten years; before the war the culture of cotton did not reach northward beyond the middle of the county. A considerable portion of the territory of this county belongs to the class of red clay lands which were originally covered with heavy forests of oak, pine coming in as a constituent of the forests only on the summits of the ridges and divides between the streams, where the soils are gray and yellow sandy loams. The higher portion of the county, which lies along the water-shed between the Yadkin and the Catawba in a north and south direction, belongs, in the main, to the latter class of soils, but has here and there small tracts of red clay. Of the county area, 36.36 per cent. is under tillage, and of this 30.85 per cent. is in cotton. This county shows a large product of cotton, ranking third in this respect; and also produces corn and the small grains on a large scale, aggregating 800,000 bushels. Gold and copper mining are important industries in several sections of the county.

Charlotte being an important railroad center, the county has ample facilities for shipment in every direction.

ABSTRACT OF THE REPORTS OF MESSRS. R. I. M'DOWELL, OF CHARLOTTE, AND WILLIAM E. ARDREY, OF PINEVILLE.

Most uplands are well adapted to the growth of cotton, which matures early, and generally not much is lost by frost. The kinds of soil cultivated in cotton are, first, *gray lands*, which have a large per cent. of sand, and cover one-fourth of the county; next, *mulatto or red lands*, with a red-clay subsoil, which cover over one-half of the county; and last, a *black-jack and post-oak land* with a hard impervious subsoil. The natural timber is oak, hickory, pine, and dogwood. The average thickness of the surface soil is from 4 to 8 inches. The chief crops are cotton, corn, wheat, and oats, but the land is best adapted to cotton, which yields best when 4 feet high, but grows from 2 to 5 feet in height. It is inclined to run to weed when the soil is a rich heavy loam or has much vegetable matter; on most lands phosphates are beneficial. Fresh land produces from 500 to 1,000 pounds of seed-cotton per acre, 1,425 pounds making a bale.

Crab-grass is the only pest dreaded in cultivation. About one-tenth of such land originally cultivated now lies turned out, but is being rapidly put in cultivation; when again taken in it does better than fresh land, especially when aided by fertilizers. The soil on the slopes is apt to wash or gully unless protected by hillside ditches. The valleys are benefited by the washings of the uplands.

IREDELL.

Population: 22,675.—White, 16,752; colored, 5,923.
Area: 595 square miles.—Woodland, 153,039 acres.
Tilled lands: 101,018 acres.—Area planted in cotton, 11,603 acres; in tobacco, 465 acres; in corn, 39,264 acres; in wheat, 17,476 acres; in rye, 359 acres; in oats, 17,488 acres.
Cotton production: 4,657 bales; average cotton product per acre, 0.40 bale, 573 pounds seed-cotton, or 191 pounds cotton lint.

Iredell is a county of rolling uplands, and lies on the waters of the Catawba on the west and of the Yadkin on the east, being mainly drained by the latter. It is divided in a northwesterly and southeasterly direction by the course of the tributary streams into broad, flattish, elevated zones, the summits of which have generally a gray and yellow loam soil, with mixed oak and pine forests and occasional tracts of red clay oak-covered soils, while along the streams, which abound in alluvial bottoms, forests of oak, walnut, hickory, etc., predominate. One of these high swells or divides lies along and quite close to the course of the Catawba river, and has an elevation of 900 feet in its southern portion, rising to 1,000 feet and upward at its northern limit. The average elevation of the county is but little below 1,000 feet above sea-level.

The cotton crop has increased tenfold since 1870, and is confined mainly to the southern half, this form of agriculture having only recently passed beyond the middle of the county. The northern section produces tobacco as its chief market crop, but corn and the small grains occupy the larger portion of the tilled surface of the county, and aggregate more than 800,000 bushels. Of the county area, 26.53 per cent. is tilled land, of which 11.49 per cent. is cultivated in cotton. Transportation is by rail, east, west, and south.

CATAWBA.

Population: 14,946.—White, 12,469; colored, 2,477.
Area: 445 square miles.—Woodland, 210,328 acres.
Tilled lands: 75,350 acres.—Area planted in cotton, 5,175 acres; in tobacco, 49 acres; in corn, 21,248 acres; in wheat, 15,054 acres; in oats, 7,566 acres.
Cotton production: 2,012 bales; average cotton product per acre, 0.39 bale, 555 pounds seed-cotton, or 185 pounds cotton lint.

Catawba county lies on the northern border of the cotton belt and on the margin of the Piedmont division of the state. It is bounded northward and eastward by the Catawba river, and has its western end on the foot-hills of the South mountains. As to its middle, southern, and eastern parts, it resembles the county of Iredell, from which it is separated by the Catawba river. Through the middle region of it, and in a northeast and southwest direction, is a broad belt of oak and hickory forest with a red-clay soil, while that of the western section is a light to yellow sandy loam. The streams of this county, all of which flow into the Catawba, are occasionally bordered by considerable tracts of alluvial lands, and along the course of the Catawba are extensive bottoms. These and the red lands of the county are very productive. In the southeastern corner, as well as along the northwestern border, are mountain spurs which rise to an elevation of 1,500 feet and more above sea-level. A broad, flattish plateau crosses the county in a northwest and southeast direction between these mountain spurs, which, for the most part, is characterized by sandy and gravelly loams, and its oak forests are intermingled with much pine.

The culture of cotton has been introduced into the county since 1870, and has become the money crop. The larger part of its territory is still devoted to grain, of which more than half a million bushels are produced. Tobacco has been added to the list of its products within a few years, nearly half of the county being well adapted to the better grades of this crop. Of the county area, 26.46 per cent. is tilled land, of which 7 per cent. is cultivated in cotton. Transportation is by railroad, east, west, and south.

LINCOLN.

Population: 11,061.—White, 8,180; colored, 2,881.
Area: 295 square miles.—Woodland, 20,293 acres.
Tilled lands: 53,571 acres.—Area planted in cotton, 7,442 acres; in corn, 19,338 acres; in wheat, 10,159 acres; in oats, 6,313 acres.
Cotton production: 2,945 bales; average cotton product per acre, 0.40 bale, 564 pounds seed-cotton, or 188 pounds cotton lint.

Lincoln county lies south of Catawba county and west of the Catawba river, and its features, agricultural and topographial, are those of that county, and may be described in nearly the same terms. Its territory is drained by the parallel courses of the numerous tributaries of the South Fork of the Catawba, which traverses its middle section, and the average elevation is nearly 1,000 feet above sea-level. In its middle portion is a north and south zone several miles in breadth of red-clay soils, with oak and hickory forests. For the rest, its forests are mixed oak and pine, and its soils are gray and yellow gravelly loams. The eastern side of the county is quite hilly near the river.

Only within the last few years has the culture of cotton entered to any considerable extent into the agriculture of this county, and it already holds the leading rank. Of the county area, 28.37 per cent. is under tillage, and of this 13.89 per cent. is in cotton. The manufactures of the county, especially in iron and cotton, have always been considerable.

Railroads cross the county in two directions, furnishing ample means of transportation.

ABSTRACT OF THE REPORT OF WILLIAM A. GRAHAM, OF IRON STATION.

The soils are chiefly of three kinds: 1, clay loam and clay; 2, gray sandy; and 3, piny old fields, chopped off. The leading soil is the *gray sandy*, with red or yellow subsoil, about two-thirds of the lands being of this description. Its natural timber is post oak, hickory, dogwood, and short-leaf pine. The average thickness of the surface soil is 6 inches; the subsoil is a tough red or yellow clay, baking hard, but becoming fine and friable when treated with vegetable matter, and tills easily. The chief crops are corn, cotton, wheat, oats, and tobacco. The soil seems best adapted to cotton, oats, and tobacco, the proportion of cotton planted being one-half. The latter usually attains a height of from 1 to 5 feet, and is most productive at from 2½ to 3 feet. It is inclined to run to weed in a wet August, or when planted on new ground and not manured with bone-dust. Fresh land produces from 400 to 600 pounds of seed-cotton per acre, and from 1,425 to 1,485 pounds are needed for a 475-pound bale. After eight years' cultivation the soil yields 250 pounds per acre, and the staple from stimulated old lands seems to be longer and stronger. Spanish needles and crab-grass are the most troublesome weeds. In the last few years much land turned out has been reclaimed and put in cotton; when again taken in it does well in wheat for a few years, and in oats and cotton as long as manured. The soil readily gullies on the slopes, and in many places serious damage is done. The valleys are to some extent injured by the washings of the uplands, but the proportion of valley to uplands is not considerable. Efforts have been made to check this damage by horizontalizing and hillside ditching, and with good success when properly attended to.

The *clay loam and clay soil* are timbered with large oaks, hickory, and poplar, and the average thickness before it changes into subsoil is from 1 to 5 inches. The subsoil is tough, and contains hard white gravel, underlaid by slate or granite at from 4 to 10 feet. The soil is apparently best adapted to wheat and corn. Cotton is most productive at from 2½ to 3 feet, and in wet weather is apt to run to weed. Fresh land produces 500 pounds of seed-cotton per acre, from 1,425 to 1,485 pounds being needed to make a 475-pound bale. After eight years' cultivation it will yield 200 pounds per acre. The *old pine-fields' soil* is about the same as No. 1.

Cotton on bottom lands being late in starting off in the spring, and growing too late in the fall, the crop is confined almost entirely to the uplands.

Cotton is shipped by wagon to Charlotte, and the rate of freight is $1 25 for 25 miles.

GASTON.

Population: 14,254.—White, 10,188; colored, 4,066.

Area: 364 square miles.—Woodland, 97,543 acres.

Tilled lands: 59,569 acres.—Area planted in cotton, 10,949 acres; in corn, 24,678 acres; in wheat, 11,566 acres; in oats, 6,699 acres.

Cotton production: 4,588 bales; average cotton product per acre, 0.42 bale, 597 pounds seed-cotton, or 199 pounds cotton lint.

Gaston, a small county, lies on the southern border of the state, and is bounded eastward by the Catawba river, whose tributaries drain its entire surface. In the southern section are several small mountain chains and spurs, the highest of which, King's mountain, reaches an altitude of nearly 1,700 feet above sea-level. Most of the county is quite broken, and partakes of the character of the Piedmont division. It is characterized by mixed forests of oak and pine and by gray and yellow gravelly soils of moderate fertility, with occasional areas of red-clay soils. In the northwestern section are the largest tracts of oak and hickory forests, with their corresponding red-clay soils.

Of the county area, 25.57 per cent. is under tillage, and of this 18.38 per cent. is in cotton. The product of cotton has increased sixfold in the last ten years.

There are many valuable beds of iron ore in the county, and the manufactures of cotton, and formerly of iron, have attained considerable importance. It is one of the oldest iron-manufacturing regions of the south, some of its furnaces dating back nearly one hundred years. In water-power it has superior advantages. It has also several noted gold mines.

ABSTRACT OF THE REPORT OF JASPER STOWE, OF LOWELL.

The soils are numerous, and vary from rich to very poor. Cold weather in late April and May is one terror to the cotton-planter, and frequently frosts in the fall kill the cotton before it matures.

About one-sixth of the cotton land is what is termed *"chincapin" land*. This soil is gray fine sandy, having a subsoil of compact red or yellow clay, and occupies patches of several square miles, forming large and small farms in all sections of the county; its timber is generally a mixed growth of oaks and pines. Cotton and corn are the chief crops, but the soil is best adapted to cotton, two-fifths of the improved land being occupied by this crop. It is most productive when 2½ feet high, and inclines to run to weed in wet seasons, for which we think deep plowing a remedy. Fresh land produces 500 pounds of seed-cotton per acre, and 1,425 pounds will make a 475-pound bale; the grade is always good. Crab-grass is the only pest. The slopes wash or gully very readily, but the damage is not extensive.

The *granite soil* occupies one-seventh of the lands in this region, and extends from northeast to southwest, in places several miles in length and half a mile in width; there are several such ranges in the county. The timber is mostly small hickories, with oaks and

pines in fair proportion. The soil is a whitish-gray, coarse, sandy, gravelly loam, to the average depth of 5 inches, when it changes into the subsoil, which is tenacious clay, sometimes porous. The former contains hard and soft granitic pebbles, and is only difficult to till in wet seasons. It is best adapted to cotton and oats, three-fifths being the proportion of cotton planted, which grows from 30 to 42 inches high. Fresh land produces from 700 to 1,500 pounds of seed-cotton per acre, and 1,425 pounds will make a 475-pound bale of lint, which rates, when clean, as good middling. No one thinks of cultivating without manuring.

The *hickory or red land* constitutes two-thirds of the region, and is timbered the same as the other soil. The subsoil is generally a stiff, deep-red clay, and the soil is best adapted to corn and wheat, though one-fourth is planted in cotton. Fresh land rarely produces 485 pounds of seed-cotton per acre, and 1,485 pounds is needed for a bale, which rates as low middling.

Cotton shipments are made in November by rail to Charlotte. Rates of freight are from 50 to 75 cents per bale.

CLEAVELAND.

Population: 16,571.—White, 13,700; colored, 2,871.
Area: 464 square miles.—Woodland, 129,115 acres.
Tilled lands: 85,752 acres.—Area planted in cotton, 19,238 acres; in corn, 31,339 acres; in wheat, 11,116 acres; in oats, 10,959 acres.
Cotton production: 6,126 bales; average cotton product per acre, 0.32 bale, 453 pounds seed-cotton, or 151 pounds cotton lint.

Cleaveland county is situated on the southern border of the state, and lies westward of Gaston county. Its northern end rests upon the summit of the South mountains, at an elevation of nearly 3,000 feet above sea-level, and its upper half belongs properly to the Piedmont division. It is drained by several large tributaries of the Broad river, which rise in this chain and cross the county southward into South Carolina. Its agricultural and topographical features are very similar to those of Catawba county, to which its territory is contiguous. Its soils consist of alternating tracts of red or reddish clay and gray and yellow gravelly loams (chiefly the latter), and have their corresponding forests of oak and of oak mingled with pine. This county produces cotton throughout its territory even up to the flanks and on the slopes of the South mountains, although this form of agriculture is the growth of a decade, the product having increased twelvefold in that time. The production of grain exceeds 500,000 bushels. Of the county area, 28.88 per cent. is tilled land, of which cotton occupies 22.43 per cent. Gold mining is also a familiar industry, placers being common in the north and vein mines in the south end.

ABSTRACT OF THE REPORT OF J. B. LOGAN, OF SHELBY.

The chief soil cultivated in cotton is a *yellow sandy soil*, which occupies three-fourths of the entire area and extends throughout the county, interspersed with tracts of red-clay land. Its natural timber is pine, hickory, oak, dogwood, poplar, and, in the mountainous part, chestnut, chestnut-oak, locust, etc. The average thickness of the surface soil is 6 inches before its color changes into that of the subsoil, which is harder and heavier than the surface soil. Cotton, corn, wheat, oats, and sorghum are the chief crops, but cotton is planted on one-fourth of the cultivated land, which grows from 2 to 2½ feet in height, and is apt to run to weed when the land is too rich naturally or planted too wide and thinned out too much. Commercial fertilizers and thicker planting are used to restrain this tendency. Fresh land produces from 600 to 1,200 pounds of seed-cotton per acre, 1,600 pounds making a 475-pound bale of lint. After four years' cultivation the product is from 300 to 500 pounds per acre, and about 1,780 pounds are needed for a bale. The lint is not so long or heavy, but probably has a firmer texture.

Rock or pigeon weed and foxtail are the most troublesome weeds. Considerable damage is done in certain localities by the washing or gullying of the slopes, especially in the white sandy land, and efforts are made with great success to prevent the damage by hillside ditching and horizontal plowing.

There are three qualities of land, however: (1) the yellow sandy, (2) the white sandy, and (3) the red rather clayey land; but not much difference in growing cotton, the yellow sandy, if any, being the best. All parts of the county, even the northern or mountainous part, grow cotton tolerably well by fertilizing with guano or phosphates.

Cotton shipments are made, by rail, to Charleston at $2 25, to Wilmington at $1 35, and New York at $2 95 per bale.

The report of E. P. Chambers, of Stice's Shoal, agrees in general with the above. He describes the prevalent soil as gray sandy, having oak and hickory forests, and some pine intermixed, and the subsoil as usually a red and sometimes yellow clay. Two-fifths of the cultivated land is in cotton, but rye is one of the chief crops. Crab-grass is the most troublesome pest. Twenty per cent. of this land lies "turned out".

The second class of land has red-clay soil, embracing more than one-fourth of the land of the region. Its growth is oak and hickory, and the soil is from 8 to 10 inches deep.

A third class is described as *black bottoms*, which embraces less than one-fourth of the lands of the region, and the subsoil is usually a blue clay. Very little of this land is planted in cotton.

RUTHERFORD.

Population: 15,198.—White, 11,910; colored, 3,288.
Area: 520 square miles.—Woodland, 180,192 acres.
Tilled lands: 63,825 acres.—Area planted in cotton, 9,679 acres; in tobacco, 38 acres; in corn, 32,783 acres; in wheat, 8,683 acres; in rye, 689 acres; in oats, 6,166 acres.
Cotton production: 2,079 bales; average cotton product per acre, 0.21 bale, 306 pounds seed-cotton, or 102 pounds cotton lint.

The topographical features of Rutherford county may be described in the same terms as those of Cleaveland, which bounds it on the east. Like that, it is traversed from its northern limit, in the South mountains, by the parallel southerly courses of several large tributaries of the Broad river. Its northern half is in many places quite rugged and mountainous (being properly a part of the Piedmont division), and its northwestern corner rests on

some of the summits of the Blue Ridge at an elevation of nearly 4,000 feet. Its soils and its agriculture correspond in all their features to those of Cleaveland county, and its cotton product has increased seventeen-fold since 1870. Gold mining is also an industry of some importance, especially in the northern section, where placers are abundant and extensive on the flanks of the South mountains and in the beds of the streams at their base. Of the county area, 19.18 per cent. is tilled land, of which 15.16 per cent. is planted in cotton.

Transportation is by wagon to the railroads of adjacent counties, and thence to Charlotte, Wilmington, and Charleston.

RANDOLPH.

Population: 20,836.—White, 17,758; colored, 3,078.

Area: 701 square miles.—Woodland, 237,999 acres.

Tilled lands: 91,693 acres.—Area planted in cotton, 595 acres; in tobacco, 45 acres; in corn, 35,338 acres; in wheat, 29,443 acres; in oats, 13,524 acres.

Cotton production: 295 bales; average cotton product per acre, 0.50 bale, 708 pounds seed-cotton, or 236 pounds cotton lint.

The southern portion of Randolph county for a few miles from its border partakes in part of the character of the long-leaf pine belt, but for much the larger part of its territory it belongs strictly to the oak upland region, its surface being quite hilly and broken, and near the western margin there are several small mountains. Through its middle region, from northwest to southeast, is an elevated ridge or divide between the waters of the Deep river and the Yadkin which has an altitude of from 700 to 900 feet above the level of the sea. The western and southern sections of the county are characterized by the occurrence of sharp ridges and hills of slate, with light-gray, sandy, gravelly soil; but the upper portion is much less broken, and consists of broad, flattish swells, which constitute the divides between the upper waters of the Haw, Deep, and Uharie rivers, the latter being one of the tributaries of the Yadkin. The soils of this portion of the county are, for the most part, gray, gravelly loams, alternated here and there with red-clay lands. Cotton is produced in only a small part of the southern half of the county, the production of small grains (700,000 bushels) constituting its principal agricultural feature. Of the county area, 20.44 per cent. is tilled land, of which only 0.65 per cent. is planted in cotton. There are several noted gold mines in this county.

Transportation is furnished by the North Carolina railroad, which crosses the upper corner of the county.

GUILFORD.

Population: 23,585.—White, 16,885; colored, 6,700.

Area: 682 square miles.—Woodland, 108,071 acres.

Tilled lands: 126,722 acres.—Area planted in cotton, 283 acres; in tobacco, 910 acres; in corn, 39,790 acres; in wheat, 27,743 acres; in rye, 354 acres; in oats, 20,774 acres.

Cotton production: 114 bales, average cotton product per acre, 0.40 bale, 573 pounds seed-cotton, or 191 pounds cotton lint.

Guilford county lies in the middle of the midland plateau, and near its highest part, on the water-shed between the Cape Fear and Dan rivers, which crosses its territory nearly midway in a west and east direction at an average elevation of between 800 and 1,000 feet above tide. In its physical characteristics and its agricultural features this county may be taken as a typical average of this region. This elevated swell of land between the water-courses, with its projections at right angles between the main tributaries of the above-mentioned rivers, is characterized by quite a uniform forest growth and soil, both of which may be taken as representative of these features for the major part of the midland division. Its forests consist mainly of oaks of various species and hickory, with a subordinate growth of short-leaf pine scattered quite uniformly over most of its area. Along its river and creek bottoms, which are in many parts of the county extensive, and in the southeastern section of the county—even on the uplands—are heavy forests of oak, intermingled with hickory, walnut, poplar, maple, etc. These lands have generally a reddish-clay loam soil. The soil of the higher and broad-backed ridges and swells is quite uniformly a yellowish sandy and gravelly loam, underlaid by a yellow and red-clay subsoil. The cotton zone barely touches the southern border, the chief crops of the county consisting of grains (of which the aggregate exceeds three-quarters of a million bushels) and tobacco, the product of which is nearly half a million pounds, grown mostly in the northern half of the county. Of the county area, 28.10 per cent. is tilled land, of which only 0.22 per cent. is planted in cotton. Gold, copper, and iron are found in many places, and have been mined on a considerable scale, chiefly before the war.

Transportation is east, west, and north by rail to Richmond, Norfolk, and New York.

ABSTRACT OF THE REPORT OF DR. D. W. C. BENBOW, OF GREENSBORO'.

The principal soil is light sandy; but about one-half the land of the region varies from tract to tract, and comprises sandy and red-clay soils, chiefly the former, and some dark loam. The natural growth is oak, hickory, ash, maple, dogwood, short-leaf pine, etc. The soil has a thickness of 5 inches over a subsoil of stiff clay, gravel, and hard-pan, and the chief crops are wheat, corn, oats, tobacco, and cotton. The height of cotton is usually 2 feet. One-third of this land lies "turned out"; it washes on the slopes, doing serious damage, but the valleys are improved 50 per cent.. Very little effort is made to check damage.

ALAMANCE.

Population: 14,613.—White, 9,997; colored, 4,616.

Area: 445 square miles.—Woodland, 71,239 acres.

Tilled lands: 72,621 acres; area planted in cotton, 211 acres; in tobacco, 1,688 acres; in corn, 24,628 acres; in wheat, 18,661 acres; in oats, 9,618 acres.

Cotton production: 91 bales; average cotton product per acre, 0.43 bale, 615 pounds seed-cotton, or 205 pounds cotton lint.

This county is drained by the upper waters of the Cape Fear river, and one of its principal tributaries, the Haw river, crosses it from the northwestern to the southeastern corner. The soils of this county are largely fertile red-clay loams, with oak and hickory forests. Slate hills, which rise to the elevation of low mountain chains, occupy the southern end of the county, and have oak and pine forests and thin, sandy loam soils. The northern portion consists of alternating tracts of gray sandy loams and red clays. The cotton belt barely touches the southern edge of the county. The upper end is devoted to the production of tobacco, and the whole of it to grain crops, of which the yield is large.

The manufacturing facilities of the county are very great, and, in number of cotton-looms and spindles, Alamance stands first of all the counties in the state. There are also gold deposits, both vein and placer, in the middle and southern sections.

Of the county area, 25.50 per cent. is tilled land, of which 0.29 per cent. is cultivated in cotton. Transportation is east and west by rail.

ABSTRACT OF THE REPORT OF J. A. GRAHAM, OF GRAHAM.

The principal soil is *sandy*, and occupies two-thirds of the lands. A gray chalky soil comprises one-third of the land. The former is in scattered patches, and has a growth of post oak, black-jack, chincapin, and white oak; its thickness is 6 inches, over a subsoil of yellow clay. The chief crops are corn, wheat, oats, cotton, and tobacco, but the soil is best adapted to the last. One-fourth of such land is in cotton, and its usual height is 2 feet, but it is most productive at 2½ feet. Fresh land produces from 1,000 to 1,200 pounds, from 1,425 to 1,545 pounds making a bale. The yield after three years' cultivation is from 800 to 1,000 pounds per acre, 1,660 pounds making a bale; but the staple from fresh land rates the best. The worst pests in cultivation are crab-grass and rag-weed. Not more than one-fifth of such lands once cultivated now lies turned out.

PERSON.

Population: 13,719.—White, 7,206; colored, 6,513.
Area: 401 square miles.—Woodland, 96,011 acres.
Tilled lands: 71,634 acres.—Area planted in cotton, 2 acres; in tobacco, 5,868 acres; in corn, 19,372 acres; in wheat, 8,974 acres; in oats, 9,821 acres.
Cotton production: 1 bale; average cotton product per acre, 0.50 bale, 711 pounds seed-cotton, or 237 pounds cotton lint.

Person county lies outside of the cotton belt, and belongs to the bright tobacco zone. Near the middle of it rise several low mountain ridges of granite and slate, with oak and pine forests. These attain an altitude of about 1,000 feet (the general elevation being from 600 to 700 feet), and have a thin gravelly and sandy soil, while the other sections are alternately of this character and of red-clay soils of greater fertility. To the latter class belong especially the northwestern and southeastern sections. The chief agricultural interest is the production of tobacco of a high grade, in which industry this is one of the leading counties. To this crop the light sandy soils are peculiarly adapted. In tobacco product Person county is fourth in rank. Of the county area, 27.91 per cent is tilled land, of which only an insignificant portion is planted in cotton.

Transportation is by wagon to the railroad in adjoining counties, and so to Richmond and the other markets.

CASWELL.

Population: 17,825.—White, 7,169; colored, 10,656.
Area: 407 square miles.—Woodland, 76,200 acres.
Tilled lands: 83,545 acres.—Area planted in cotton, 6 acres; in tobacco, 10,174 acres; in corn, 25,663 acres; in wheat, 10,841 acres; in oats, 14,441 acres.
Cotton production: 4 bales; average cotton product per acre, 0.67 bale, 951 pounds seed-cotton, or 317 pounds cotton lint.

Caswell county duplicates the features of Person, both agriculturally and topographically, except that the mountains are wanting. The larger part of its territory is devoted to the production of bright yellow tobacco, while grain crops occupy a comparatively subordinate position, and are produced principally along the river and creek bottoms which abound in the northern and eastern sections of this county. The northeastern section consists largely of red-clay lands, with oak and hickory forests, while the lighter tobacco soils occupy most of the southern and western portions. Caswell ranks third among the tobacco counties in aggregate product. Of the county area, 32.07 per cent. is tilled land, of which 0.01 per cent. is planted in cotton.

Transportation is furnished by the Richmond and Danville railroad and a branch of it.

ROCKINGHAM.

Population: 21,744.—White, 12,431; colored, 9,313.
Area: 582 square miles.—Woodland, 138,200 acres.
Tilled lands: 77,439 acres.—Area planted in cotton, 5 acres; in tobacco, 9,332 acres; in corn, 25,175 acres; in wheat, 11,298 acres; in rye, 301 acres; in oats, 15,200 acres.
Cotton production: 3 bales; average cotton product per acre, 0.60 bale, 855 pounds seed-cotton, or 285 pounds cotton lint.

Rockingham, like the two preceding, is a border county, and belongs to the same famous bright tobacco belt. It is traversed in a northeasterly course by the waters of the Dan river, and its southern section is drained by the upper tributaries of the Cape Fear (Haw) river. The northwestern corner of this county, constituting about one-third of its territory, near the Virginia line and north of the Dan river, consists for the most part of elevated flattish ridges and swells having gray, yellow, gravelly loam soils, while the southern and eastern two-thirds of the county consist of alternating belts of these loams and of red clays. Besides tobacco, in which this county ranks second, large crops of

grain are produced—upward of 600,000 bushels. Dan river, with its tributaries, furnishes abundant water-power, and the former stream is navigable in a small way for flat-boats. A bed of semi-bituminous coal, 3 feet in thickness, and of good quality, outcrops in the eastern section, but it has been but little mined. Of the county area, 20.79 per cent. is tilled land, of which only 0.01 per cent. is planted in cotton.

Shipments are made by rail to Danville, Richmond, and other markets.

STOKES.

Population: 15,353.—White, 11,730; colored, 3,623.

Area: 476 square miles.—Woodland, 131,483 acres.

Tilled lands: 53,369 acres.—Area planted in cotton, 13 acres; in tobacco, 4,690 acres; in corn, 19,969 acres; in wheat, 9,374 acres; in rye, 1,195 acres; in oats, 8,408 acres.

Cotton production: 7 bales; average cotton product per acre, 0.54 bale, 768 pounds seed-cotton, or 256 pounds cotton lint.

Stokes is another border county, and belongs also to the bright tobacco belt. It is drained by the upper tributaries of the Dan, and belongs to the Piedmont division of the state. Its surface is for the most part quite rugged and broken, containing the terminal spurs and ridges of the Brushy mountains, which here attain an elevation of more than 2,500 feet above the sea. The general elevation is above 1,000 feet. The forests of this county and of the Piedmont region generally contain an added element, the chestnut, on elevated ridges and mountain slopes, and the proportion increases with the elevation. A new species of oak also makes its appearance, the chestnut oak, which occupies the crests and upper slopes of the poorer stony and gravelly ridges of the whole mountain region. The proportion of sourwood (*Oxydendron*) also increases to such an extent in the Piedmont region as to become a marked characteristic of its forests, and is indicative of a scant soil. It is worthy of note that, with the extinction of the herbage which originally mantled the soil and kept it moist, the chestnut has almost disappeared in half a century from the upper midland counties, and is dying out slowly in the Piedmont region.

The soils of this county resemble those of Rockingham, being predominantly yellow and gray gravelly loams, with occasional red-clay belts, the former well adapted to the production of the higher grades of tobacco, which constitutes the chief element of its agriculture, and in the total product of which this county stands fifth. Its manufacturing facilities are great but undeveloped, and it is rich in iron ores. Its agriculture has the advantage of the presence of several limestone beds, and there are also outcrops of semi-bituminous coal in the southeastern section. Of the county area, 17.52 per cent is tilled land, of which only 0.02 per cent. is planted in cotton.

Transportation is by wagon, and occasionally by flat-boats on the Dan river. A railroad from Greensboro' is nearly finished to the border.

FORSYTH.

Population: 18,070.—White, 13,441; colored, 4,629.

Area: 364 square miles.—Woodland, 91,053 acres.

Tilled lands: 59,157 acres.—Area planted in cotton, 16 acres; in tobacco, 1,693 acres; in corn, 20,920 acres; in wheat, 13,590 acres; in rye, 492 acres; in oats, 11,780 acres.

Cotton production: 10 bales; average cotton product per acre, 0.63 bale, 891 pounds seed-cotton, or 297 pounds cotton lint.

Forsyth county lies west of Guilford, and is bounded on the west by the Yadkin river. Through its middle portion is a broad swell or plateau, the divide between the waters of the Yadkin and Dan, with an elevation of from 1,000 to 1,200 feet, and having forests of oak, dogwood, sourwood, pine, etc. Its soils are light, gray loams. The tributaries of the Yadkin, which drain the southwestern section, abound in bottom lands of great fertility, and have heavy oak forests, interspersed with hickory, walnut, poplar, etc., while the middle, northern, and eastern sections are characterized largely by gray sandy loam soils, with forests of oak and pine. This county shows an increasing product of the better and medium grades of tobacco, but it produces chiefly grain crops—an aggregate of more than 500,000 bushels. Of the county area, 25.39 per cent. is tilled land, of which cotton occupies only 0.03 per cent.

Transportation is by rail to Greensboro' and to the other markets beyond.

DAVIE.

Population: 11,096.—White, 7,770; colored, 3,326.

Area: 289 square miles.—Woodland, 63,566 acres.

Tilled lands: 59,272 acres.—Area planted in cotton, 790 acres; in tobacco, 1,205 acres; in corn, 22,125 acres; in wheat, 13,244 acres; in rye, 444 acres; in oats, 13,366 acres.

Cotton production: 302 bales; average cotton product per acre, 0.38 bale, 546 pounds seed-cotton, or 182 pounds cotton lint.

The small county of Davie lies in the angle between the Yadkin and the South Yadkin rivers, and resembles in its general features the preceding county. It also corresponds with that county in its agricultural productions. In the southern half of this county the soils belong largely to the class of red clays, and are covered with heavy oak forests, while the middle and northern portions have a mixed growth of oaks and pines and a light-gray, sandy, and gravelly soil. This section of the county is mainly devoted to the culture of tobacco. The river hills, flanking both the Yadkin and its chief tributaries, are quite broken, and have a productive gravelly loam soil and forests predominantly of oak. The elevation of the surface ranges from 700 to 1,000 feet, the average being about 850 feet above sea-level. The culture of cotton has recently entered the southern and western townships. The grain crop is quite large, exceeding 650,000 bushels; and latterly also tobacco has been cultivated to a considerable extent in the north and west sections, the soils of a large part of its territory being well adapted to the higher grades. There are several valuable iron-ore deposits in the county. Of the county area, only 32.05 per cent. is tilled land, and the proportion of cotton planted is 1.33 per cent. of the latter.

Transportation is furnished by the Western North Carolina railroad, which crosses the adjacent county of Rowan.

YADKIN.

Population: 12,420.—White, 10,876; colored, 1,544.
Area: 351 square miles.—Woodland, 89,582 acres.
Tilled lands: 52,816 acres.—Area planted in cotton, 87 acres; in tobacco 425 acres; in corn, 21,735 acres; in wheat, 10,190 acres; in rye, 821 acres; in oats, 11,289 acres.
Cotton production: 26 bales; average cotton product per acre, 0.30 bale, 426 pounds seed-cotton, or 142 pounds cotton lint.

Yadkin county lies immediately north of Davie, in the bend of the Yadkin river, which bounds it northward and eastward. It is traversed in a nearly east and west course by the Brushy mountains, which here drop down into low spurs and swells, the average elevation of the county being probably not greater than 1,200 feet. Its soils and forests are like those of Davie county. Its agricultural interest is divided between the production of tobacco and grain crops, the product of the latter nearly reaching half a million bushels. Cotton culture has invaded its southern border to a small extent within a few years. There are several iron mines in the county, but they have been little worked, as they are too far from market. Of the county area, 23.51 per cent. is tilled land, of which 0.16 per cent. is planted in cotton.

No railroad has yet reached the county.

SURRY.

Population: 15,302.—White, 13,227; colored, 2,075.
Area: 476 square miles.—Woodland, 188,631 acres.
Tilled lands: 69,011 acres.—Area planted in cotton, 3 acres; in tobacco, 2,136 acres; in corn, 25,334 acres; in wheat, 9,823 acres; in rye, 3,027 acres; in oats, 9,199 acres; in buckwheat, 71 acres.
Cotton production: 1 bale; average cotton product per acre, 0.33 bale, 474 pounds seed-cotton, or 158 pounds cotton lint.

Surry is a north border county contiguous to the Blue Ridge, and belongs to the Piedmont section of the state. The Yadkin river is its southern boundary. Its western section is quite mountainous, and there are small mountains in the middle; so that its surface is quite broken, and its average elevation is nearly 1,400 feet. Its soils and forests are like those of the neighboring counties, Stokes and Forsyth, the high slaty ridges and mountains, as well as much of the rolling surface, having a light gray, sandy loam soil and forests of oak and pine, with sourwood and chestnut, while the better tracts of reddish clay loams have a predominant growth of oaks, hickory, poplar, etc., with little or no pine.

The agriculture of the county is like that of Stokes, tobacco of the better grades being the chief market crop, but of greatly less value than the grain product, which exceeds 500,000 bushels. The water-power of the county is notable, a number of large tributaries of the Yadkin crossing its territory with a fall of several hundred feet. This is a feature common to the whole Piedmont region. There are several cotton factories and iron mines and forges in the county. Of the county area, 22.65 per cent. is tilled land, of which only an insignificant portion is cultivated in cotton.

WILKES.

Population: 19,181.—White, 17,257; colored, 1,924.
Area: 626 square miles.—Woodland, 268,834 acres.
Tilled lands: 80,512 acres.—Area planted in cotton, 107 acres; in tobacco, 110 acres; in corn, 34,865 acres; in wheat, 9,515 acres; in rye, 5,236 acres; in oats, 8,240 acres; in buckwheat, 218 acres.
Cotton production: 29 bales; average cotton product per acre, 0.27 bale, 387 pounds seed-cotton, or 129 pounds cotton lint.

Wilkes county lies west of Surry, and differs from it only in being more mountainous and rugged and having a greater average elevation—not less than 1,500 feet. Its northern margin rests on the summits of the Blue Ridge (at an elevation of from 3,000 to 4,000 feet), its southern on the Brushy mountains (from 2,000 to 2,500 feet above sea-level), and its whole surface is carved into a succession of mountain ridges and narrow intervening valleys by the Yadkin and its numerous tributaries. Its agriculture and its forests may be described in the same terms as were those of Surry, except that, with the increase of elevation, the growth of chestnut increases, and a new forest element enters, to a small extent, in the white pine (*P. strobus*), both in the South mountains and on the flanks of the Blue Ridge. Along the margin of the Yadkin river and its larger tributaries are frequent and wide tracts of sandy and clay bottom lands. In various parts of the county are small areas of reddish clay soil, but much the larger part of it shows the average oak upland soil, yellow or gray sandy loam. The lighter soils are well adapted to the highest grades of tobacco, the culture of which begins to enter largely into its agriculture. Of the county area, 20.10 per cent. is tilled land, of which only 0.13 per cent. is planted in cotton. The water-power of the county is very large, the sources of its multitude of rivers having an elevation of from 2,000 to 3,000 feet above tide, and their mouths less than 1,000 feet.

ALEXANDER.

Population: 8,355.—White, 7,458; colored, 897.
Area: 245 square miles.—Woodland, 82,690 acres.
Tilled lands: 41,572 acres.—Area planted in cotton, 617 acres; in tobacco, 28 acres; in corn, 16,789 acres; in wheat, 6,376 acres; in rye, 760 acres; in oats, 7,503 acres.
Cotton production: 182 bales; average cotton product per acre, 0.29 bale, 420 pounds seed-cotton, or 140 pounds cotton lint.

Alexander, one of the smallest counties in North Carolina, lies south of Wilkes, and is separated from it by the chain of the Brushy mountains. A large part of this county is traversed or penetrated by spurs and high ridges thrown off southward from that range, many of which rise to the elevation of 2,000 feet, and its territory is drained southward by the tributaries of the Catawba. The southeastern section, as well as the middle, is characterized largely by oak forests, with red clay soils, the higher divides and ridges and spurs showing a large admixture of pine and chestnut and a more open, light colored, and sandy soil. The northern, western, and northeastern sections are quite broken and mountainous. The culture of cotton has entered the territory of this county within the last few years, though its product amounts to but a few score of bales. Tobacco is cultivated to some extent on the lighter soils, but corn and wheat are the principal products. It has ample, but undeveloped, water-power, and it has iron-ore beds of considerable extent, as well as a great variety of other minerals. Of the county area, 26.51 per cent. is tilled land, of which 1.49 per cent. is planted in cotton.

ABSTRACT OF THE REPORT OF W. P. BURKE, OF TAYLORSVILLE.

The chief soil is a clay *gravelly loam*, embracing three-fourths of the lands, and having a natural timber growth of oaks, hickory, and pine. The thickness of the soil is 8 inches over a red-clay subsoil. The chief crops are corn, wheat, and oats. The proportion planted in cotton is 1 acre in 25; the usual height is 3 feet, and it is most productive at 2½ feet. Fresh land produces 600 pounds of seed-cotton per acre, 1,425 pounds making a bale of lint. None of these lands lie turned out. The soil easily gullies on slopes, but there is no serious damage done.

Transportation is by wagon to the railroad at Statesville.

CALDWELL.

Population: 10,291.—White, 8,691; colored, 1,600.

Area: 495 square miles.—Woodland, 151,637 acres.

Tilled lands: 41,512 acres.—Area planted in cotton, 30 acres; in tobacco, 75 acres; in corn, 17,315 acres; in wheat, 8,211 acres; in rye, 684 acres; in oats, 3,886 acres.

Cotton production: 12 bales; average cotton product per acre, 0.40 bale, 570 pounds seed-cotton, or 190 pounds cotton lint.

Caldwell county lies upon the flanks of the Blue Ridge, and extends southward beyond the Brushy mountains, a smaller and parallel range 2,000 feet and more in altitude. It is drained by the upper tributaries of the Catawba river and of the Yadkin, the larger of which rise in the summits of the Blue Ridge and its culminating region in Grandfather mountain, which touches the elevation of nearly 6,000 feet above the sea. This mountain throws off a number of long, heavy spurs down to the middle of the county; and is traversed midway in a direction parallel to the other two chains by the Warrior mountains, so that its surface is for the most part quite broken and rugged; but the different chains are separated by extensive open valleys, and there is a great area of river and creek bottoms. The lands in the middle and southern sections generally have a red clay or yellow sandy loam soil of more than medium fertility, while its higher regions, on the ridges and spurs of the mountains, are frequently slaty ledges, with gray sandy and gravelly soils of medium to low quality. Its forests are predominantly of oak in the middle section and of pine and oak in the southern and northern, that is, in the more mountainous regions, while in the latter section white pine, hemlock, and chestnut constitute a considerable element of the forest growth. The chief crops are grain, but tobacco culture has been recently introduced, and for a few years past a few bales of cotton have been raised in an experimental way. Of the county area, 13.10 per cent. is tilled land, of which 0.07 per cent. is cultivated in cotton. Of minerals the county contains gold and iron, the former in both placers and veins.

Transportation is furnished by the Western North Carolina railroad, which crosses the neighboring counties south, and a narrow-gauge road is nearly finished to the center of the county.

BURKE.

Population: 12,809.—White, 10,088; colored, 2,721.

Area: 489 square miles.—Woodland, 129,089 acres.

Tilled lands: 42,545 acres.—Area planted in cotton, 752 acres; in tobacco, 58 acres; in corn, 22,613 acres; in wheat, 10,016 acres; in rye, 1,054 acres; in oats, 3,455 acres.

Cotton production: 361 bales; average cotton product per acre, 0.48 bale, 684 pounds seed-cotton, or 228 pounds cotton lint.

Burke county lies westward of Caldwell on both sides of the Catawba river, which traverses its middle section and drains its entire territory. Its southern flank lies upon the crests of the South mountains, which here reach an elevation of over 3,000 feet above the sea and send off spurs in a northerly and northeasterly direction almost to the middle of the county. The northern end is elevated upon two of the most massive spurs of the Blue Ridge, Linville and Table Rock, which here rise to an elevation of nearly 4,000 feet; and from this are thrust out numerous long and rugged spurs and ridges in a southeasterly course. A large part of the territory of this county, therefore, is mountainous, and the average elevation is not less than 1,300 feet. In its middle section are considerable tracts of red-clay soils, with forests predominantly of oak, hickory, etc., while the remainder of the county is characterized in this respect by mixed forests of oak, pine, chestnut, etc., with white pine in the mountains of the south and north. The river and creek bottoms are very extensive and fertile, and have light-colored clays, loams, and sandy soils. In the middle section, on both sides of the river, the uplands usually have a red-clay soil and oak forests. The other parts of the county have soils of a lighter color, yellowish to gray loams, and forests of the usual mixed character of the region—oak, pine, chestnut, sourwood, dogwood, etc. Placer gold mines are numerous in the South mountains, and there are several vein mines on the north side of the county. Cotton and tobacco have been added to the list of cultivated crops within a few years, but grain forms the chief crop, and has an aggregate yield of 400,000 bushels. Of the county area, 13.59 per cent. is tilled land, of which 1.78 per cent. is planted in cotton.

Transportation is by rail, east and west.

McDOWELL.

Population: 9,836.—White, 7,936; colored, 1,897.
Area: 545 square miles.—Woodland, 122,129 acres.
Tilled lands: 34,798 acres.—Area planted in cotton, 23 acres; in tobacco, 100 acres; in corn, 17,675 acres; in wheat, 6,397 acres; in rye, 1,360 acres; in oats, 1,690 acres.
Cotton production: 9 bales; average cotton product per acre, 0.39 bale, 558 pounds seed-cotton, or 186 pounds cotton lint.

McDowell county lies on the eastern flank of the Blue Ridge near its highest parts, which exceeds in this region an elevation of 5,500 feet, and its whole territory may be described as mountainous. Its average elevation is more than 1,500 feet, and it is for the most part drained by the headwaters of the Catawba river. The southern and broader end of its triangular territory is traversed east and west by the South mountains, a long eastward projection or spur from the Blue Ridge. Along the course of the Catawba river and some of its chief tributaries are wide tracts of sandy and alluvial bottoms, which are very productive. The hilly and mountainous tracts have the usual variety of gray and yellowish oak uplands soils of medium fertility and mixed forests of oak, pine, chestnut, etc. Reddish clay-loam soils, with a preponderant oak forest, are found in patches here and there in the middle and southeastern sections. A large proportion of the soils of the county are well adapted to the better grades of tobacco, and the agriculture of the county has the great advantage of an abundance of limestone in the northern and middle sections. Gold mining in the South mountains has long been an important industry, several mica mines having been opened, and some attention is given to lumbering. There is a large amount of valuable timber on the slopes of the Blue Ridge and in the mountain coves, which must become the foundation of important manufactures, and then there is an indefinite amount of water-power. Iron ores of low grade are abundant. Of the county area, 9.98 per cent. is tilled land, of which 0.07 per cent. is planted in cotton.

Transportation is by rail, east and west.

POLK.

Population: 5,062.—White, 3,918; colored, 1,144.
Area: 257 square miles.—Woodland, 72,813 acres.
Tilled lands: 21,027 acres.—Area planted in cotton, 1,646 acres; in corn, 10,632 acres; in wheat, 1,896 acres; in rye, 606 acres; in oats, 877 acres.
Cotton production: 362 bales; average cotton product per acre, 0.22 bale, 312 pounds seed-cotton, or 104 pounds cotton lint.

Polk is the southernmost of the Piedmont counties, lying upon the border of South Carolina, and of the cotton belt, which barely enters its southeastern corner. Three-fourths of the territory of the county is very mountainous, as it is bounded westward by the Blue Ridge; and its western and northern sections are penetrated by heavy and long spurs, thrown out from that range, of equal height or greater. It is crossed from west to east and nearly its entire territory is drained by the waters of Green river, one of the principal tributaries of the Broad. Along this river valley, as well as on some of the tributaries, are wide stretches of bottom lands of clay and sandy loams. The middle part of the county is a somewhat broken plateau of 1,000 feet elevation, and has a gravelly and slaty soil of a light color and loose texture and low fertility, and inferior forests of pine, oak, and chestnut. The southeastern section is of the same character. A large part of the uplands and of the mountain slopes in the west and north has forests largely of oak and a yellowish or gray loamy soil of good quality. In the higher parts, except where the soil is of the better grades, chestnut and chestnut oak are abundant. The principal agricultural pursuit is the production of grain crops, cotton being a new crop to the region, and as yet little cultivated. There are several gold mines in the middle and southern sections. Of the county area, 12.78 per cent. is tilled land, of which 7.83 per cent. is planted in cotton. Produce is shipped south by rail.

THE TRANSMONTANE REGION.

(Embraces the following counties: Alleghany, Ashe, Watauga, Mitchell, Yancey, Madison, Buncombe, Henderson, Transylvania, Haywood, Jackson, Macon, Swain, Graham, Clay, and Cherokee.)

ALLEGHANY.

Population: 5,486.—White, 4,967; colored, 519.
Area: 276 square miles.—Woodland, 74,859 acres.
Tilled lands: 46,198 acres.—Area planted in cotton, none; in corn, 7,201 acres; in wheat, 1,760 acres; in rye, 3,121 acres; in oats, 1,933 acres; in buckwheat, 755 acres.

Alleghany county is situated on the Virginia border, and is bounded southward by the curves of the Blue Ridge. In its middle section is a parallel and higher chain. Its entire surface is drained northward into the New and the Kanawha rivers, this, with the two following counties, constituting the New River plateau or basin, the only part of the state drained by the Ohio. It lies on the northeastern end of the long, narrow, elevated transmontane plateau, and has an average elevation of not less than 2,800 feet. Its forests are of oak, chestnut, and pine, with an admixture of white pine in the coves of the Blue Ridge and between that and the Peach Bottom range. Its soils are the common gray and yellow upland loams. Along the banks of the New river and its principal tributaries, especially Little river, are considerable tracts of bottom lands. Its agriculture is divided between the production of grains and grasses and cattle raising. Its products of buckwheat and rye are next to the largest in the state. Of the county area, 26.15 per cent. is tilled land.

ASHE.

Population: 14,437.—White, 13,471; colored, 966.
Area: 370 square miles.—Woodland, 166,973 acres.
Tilled lands: 70,207 acres.—Area planted in cotton, none; in tobacco, 60 acres; in corn, 15,616 acres; in wheat, 5,473 acres; in rye, 4,685 acres; in oats, 3,357 acres; in buckwheat, 818 acres.

Ashe county lies in the northwestern corner of the state, adjoining the states of Virginia and Tennessee, its southeastern edge resting upon the summits of the Blue Ridge mountain chain. It is very rugged and mountainous, the spurs of the Smoky mountains being thrust out almost across its entire territory and reaching at various points an elevation of nearly 5,000 feet, giving an average elevation of 3,500 feet above tide. It is drained by the two forks of New river, which meet in its northeast corner. Its forests, soils, and agriculture resemble those of Alleghany county. Grass and cattle count for much in this region, and rye and buckwheat are its common crops, as well as of Alleghany and the whole transmontane plateau. In the former (rye) this county shows the largest product in the state, and in the second it is nearly equal to the best. White pine and hemlock, as well as poplar, sugar maple, wild cherry, and walnut, become important constituents of the forests in many places. Of the county area, 29.65 per cent. is tilled land.

WATAUGA.

Population: 8,160.—White, 7,746; colored, 414.
Area: 370 square miles.—Woodland, ——— acres.
Tilled lands: 44,753 acres.—Area planted in cotton, 10 acres; in corn, 8,227 acres; in wheat, 2,957 acres; in rye, 2,387 acres; in oats, 1,828 acres; in buckwheat, 951 acres.
Cotton production: 3 bales; average cotton product per acre, 0.30 bale, 429 pounds seed-cotton, or 143 pounds cotton lint.

Watauga county occupies the whole breadth of the narrower part of the transmontane plateau, being bounded for the most part northwestward by the Smoky range and southeastward by the Blue Ridge. It is traversed in a northerly course by two massive cross-chains connecting the summits of the Blue Ridge and Smoky mountains, the Rich mountains and the chain of Hanging Rock and Beech. Its average elevation would about equal that of Ashe county—3,500 feet. Its whole surface is rugged and mountainous, with the exception of a few limited tracts along the two principal rivers, where considerable valleys open out, with occasional stretches of bottom lands. The soils and forests, as well as the predominant agricultural features of this county, are like those of Ashe county. There is great abundance of chestnut in its forests, and on the Rich mountains there are great quantities of linden (*Tilia*). Its high levels and benches are the best grass lands in the state, and in consequence cattle-raising enters largely into its agriculture. It also produces corn and small grains in considerable quantities, including wheat, rye, and buckwheat, the county leading in the last-named crop. Of the county area, 18.89 per cent. is tilled land, of which very little is cultivated in cotton.

MITCHELL.

Population: 9,435.—White, 8,932; colored, 503.
Area: 401 square miles.—Woodland, 105,586 acres.
Tilled lands: 31,975 acres.—Area planted in cotton, 15 acres; in tobacco, 77 acres; in corn, 11,894 acres; in wheat, 3,374 acres; in rye, 1,358 acres; in oats, 3,990 acres; in buckwheat, 378 acres.
Cotton production: 6 bales; average cotton product per acre, 0.40 bale, 570 pounds seed-cotton, or 190 pounds cotton lint.

Mitchell county is a continuation of the southern Appalachian plateau, and with Yancey, the next county described, occupies the basin of the Nolechucky or Toe river, which drains the highest masses and summits of the Blue Ridge and Black mountains. On its northern border the Smoky mountains reach an elevation of 6,400 feet, while the Blue Ridge, which forms its southeastern boundary, has an elevation ranging from 3,000 to nearly 6,000 feet. Its surface is for the most part very mountainous, and has an elevation which would probably reach an average of 3,000 feet above the sea.

The mountains of this county, as well as those of the other parts of the plateau, are generally covered with heavy forests of oak, chestnut, and pine, with a mixture here and there in the coves and on the higher slopes of white pine, hemlock (*Abies Canadensis*), and black birch, while the lower slopes are covered with linden (two species), sugar maple, poplar, walnut, cherry, ash, etc.

The soils of this county vary in their texture and composition, and belong to the general region of oak uplands soils, being for the most part gray and yellow gravelly and sandy loams, with occasional strips of red lands. The mountains here, as in the two preceding counties, are generally covered to their summits with a fertile soil and heavy forests, the exception being some of the higher dome-like masses of the Smoky mountains (notably the Roan), which are bald upon their summits, and are, in fact, simply prairies. The average elevation of this county above the sea will exceed 3,000 feet. Its agriculture resembles that of the two preceding counties, the conditions being well adapted for the most part to cattle-raising, as well as to the production of grain crops. Tobacco culture has recently been introduced, but mica mining is the most important and profitable industry, while along its northern border are some of the finest iron-ore beds known. The first southern mica mines were opened here in 1868. Of the county area, 12.46 per cent. is tilled land, of which 0.05 per cent. is cultivated in cotton.

YANCEY.

Population: 7,694.—White, 7,369; colored, 325.
Area: 276 square miles.—Woodland, 109,776 acres.
Tilled lands: 34,703 acres.—Area planted in cotton, none; in tobacco, 84 acres; in corn, 11,200 acres; in wheat, 3,940 acres; in rye, 1,290 acres; in oats, 3,657 acres.

The description of Mitchell, the preceding county, applies to Yancey. It completes with that the basin of the Toe river or Nolechucky, one of the main affluents of the Tennessee river. The massive spur of the Black mountains rises in the middle of its southern end and projects northward almost to its center. This spur reaches an elevation in its middle portion of nearly 7,000 feet, and is the highest mountain east of the Mississippi river. Between this mountain spur and the Blue Ridge is a deep, narrow valley, in which rises and flows South Toe river, while on its westward flanks rises, in a similar gorge, Caney river, another of the confluents of the Nolechucky. The county is bounded on the southwest by a cross-chain from the Blue Ridge to the Smoky mountains, the northwest Black mountains, which through a considerable part of its course reaches an elevation of 5,000 feet and upward. The whole territory of this county, therefore, is exceedingly rugged and mountainous, and the larger part of its surface is adapted only to grazing; but in the valleys and troughs between the mountain spurs and ranges are considerable stretches of undulating and hilly land and occasional tracts of considerable extent of bottom land, which are very productive in corn and small grains. The culture of tobacco has also penetrated into this county within the last few years. The tilled land occupies 19.65 per cent. of the county area. The timbers and soils are similar to those of Mitchell county, and mica mining holds here a similar place of importance. Above 5,000 feet the principal growth on the Black mountains is two species of fir, *Abies Fraseri* and *A. nigra* (spruce). These trees are also found on the summits of the Roan and Grandfather, and farther west on the Balsam mountains. Lumber mills have multiplied very rapidly in the great forests of the last three counties, and enormous quantities of cherry, walnut, ash, sugar maple, and poplar lumber have been manufactured and exported in the last year.

MADISON.

Population: 12,810.—White, 12,351; colored, 459.
Area: 457 square miles.—Woodland, 157,618 acres.
Tilled lands: 57,490 acres.—Area planted in cotton, 12 acres; in tobacco, 1,626 acres; in corn, 17,816 acres; in wheat, 7,702 acres; in rye, 816 acres; in oats, 4,238 acres.
Cotton production: 4 bales; average cotton product per acre, 0.33 bale, 474 pounds seed-cotton, or 158 pounds cotton lint.

Madison county, with Buncombe, Henderson, and Transylvania, make the plateau or basin of the French Broad the largest of these natural subdivisions of the plateau. It is bounded northward by the Smoky mountains. Its territory is also very rugged and broken, being not only surrounded by heavy, massive chains of mountains, but crossed and cut up by heavy spurs of those principal chains. Its soils, forests, and agricultural productions are like those of the preceding counties, except that bright yellow tobacco has recently become its most important crop, and already nearly reaches a million pounds per annum. It has also a larger proportion of white pine in its forests, and its iron-ore deposits are extensive and valuable. Of the county area, 19.66 per cent. is tilled land, of which 0.02 per cent. is cultivated in cotton.

BUNCOMBE.

Population: 21,909.—White, 18,422; colored, 3,487.
Area: 614 square miles.—Woodland, 226,454 acres.
Tilled lands: 77,628 acres.—Area planted in cotton, 1 acre; in tobacco, 947 acres; in corn, 29,108 acres; in wheat 17,501 acres; in rye, 2,966 acres; in oats, 6,967 acres; in buckwheat, 575 acres.

Buncombe county occupies the middle portion of the French Broad valley. Its eastern border lies upon the summits of the Blue Ridge and the Black mountains, and its western upon the summits of the cross-chain called the Newfound mountains. The valley of the French Broad here is a wide, open basin, with considerable tracts of undulating and hilly land and moderately mountainous tracts, while along its margin on every side are heavy mountain spurs. The forests and soils are of the usual familiar description, and the agriculture resembles in its main features that of the Piedmont division, consisting chiefly of the production of grains, of which the total is 650,000 bushels, and to a moderate (but rapidly increasing) extent of tobacco. Cattle-raising occupies a subordinate position. The tilled lands occupy 19.75 per cent. of the county area. The crossing of two great railroad lines at Asheville, in the center of the county, gives it a commanding commercial position, and it is the center of a great summer travel. The average elevation of the French Broad plateau is about 2,500 feet.

HENDERSON.

Population: 10,281.—White, 8,893; colored, 1,388.
Area: 351 square miles.—Woodland, 106,441 acres.
Tilled lands: 38,595 acres.—Area planted in cotton, 10 acres; in tobacco, 29 acres; in corn, 16,407 acres; in wheat, 2,598 acres; in rye, 3,734 acres; in oats, 2,908 acres; in buckwheat, 107 acres.
Cotton production: 4 bales; average cotton product per acre, 0.40 bale, 570 pounds seed-cotton, or 190 pounds cotton lint.

Henderson county is a continuation southward of the French Broad valley described in Buncombe county, and its topographical features are very similar, except that there are broader areas of comparatively level and undulating lands, but of less fertility, the soils being predominantly light gray gravelly loams, and its forests being mixed growths of oak and pine, with hemlock and chestnut. Near the water-courses, in the mountain coves, are found walnut, cherry, maple, and occasionally white pine. The chief productions of this county are corn and small grains, the culture of tobacco being very recently introduced, and then only to a very small extent. There is a large aggregate surface of bottom lands in the county, those on the French Broad being very extensive and fertile. Of the county area, 17.18 per cent. is tilled land, of which 0.03 per cent. is cultivated in cotton.

Transportation is southward by rail.

TRANSYLVANIA.

Population: 5,340.—White, 4,823; colored, 517.

Area: 382 square miles.—Woodland, 77,815 acres.

Tilled lands: 17,967 acres.—Area planted in cotton, none; in corn, 9,762 acres; in wheat, 869 acres; in rye, 3,289 acres; in oats, 257 acres.

Transylvania county occupies the upper portion of the valley of the French Broad, and lies along the flanks of the Blue Ridge and on the southern border of the state. It is bounded westward by a heavy cross-chain from the Blue Ridge to the Smoky mountains, the Balsam mountains, which rises throughout a considerable part of its course above 6,000 feet. This county is therefore the most elevated portion of the plateau of the French Broad. It is mostly mountainous and rugged, with spurs and knobs of mountains thrust out from the cross-chains which bound it. There are very extensive tracts of bottom lands along the tortuous course of the French Broad, reaching often a breadth of 1 or 2 miles, which are very fertile and produce immense crops of corn. The larger portion of the county, however, is only adapted to grazing. Its forests resemble those of the plateau generally, but contain a larger intermixture of white pine, as well as of hemlock, sugar maple, walnut, and cherry. The tilled lands occupy 7.35 per cent. of the county area.

HAYWOOD.

Population: 10,271.—White, 9,787; colored, 484.

Area: 582 square miles.—Woodland, 115,632 acres.

Tilled lands: 40,474 acres.—Area planted in cotton, none; in tobacco, 100 acres; in corn, 17,254 acres; in wheat, 10,054 acres; in rye, 757 acres; in oats, 4,099 acres; in buckwheat, 633 acres.

Haywood county occupies the plateau or basin between the parallel cross-chains of the Newfound and the Balsam mountains, which lie at right angles to the main chains (the Blue Ridge and Smoky) at an average distance from each other of about 20 miles.

This basin is drained by the waters of Pigeon river, one of the tributaries of the French Broad, which enters it beyond the Smoky mountains in Tennessee. This county is hemmed in on all sides by high mountain chains of 3,000, 5,000, and 6,000 feet and more above the sea. Its territory is exceedingly broken and rugged; yet there are considerable tracts of open, moderately hilly lands along the water courses, and occasional wide stretches of fertile bottoms, especially on the upper confluents of the river and near the middle of the basin. The average elevation is above 3,000 feet.

The soils are of the usual description, and are above average fertility. It is one of the best grazing sections, and produces all the grain crops of the region, including rye and buckwheat, but, as yet, little tobacco. The mountains are clothed to their summits with forests of a great range of species. On the lower slopes and in the rich coves, besides the usual characteristic oaks, hickories, cucumbers, poplar, chestnut, etc., are found in abundance walnut, black locust, cherry, and ash, and a little higher sugar maple, linden, black birch, and beech, and on the highest ranges two species of fir. Since the advent of the railroad lumbering is rapidly becoming an important industry. The tilled land occupies 10.87 per cent. of the county area.

JACKSON.

Population: 7,343.—White, 6,591; colored, 752.

Area: 532 square miles.—Woodland, 136,317 acres.

Tilled lands: 28,606 acres.—Area planted in cotton, 16 acres; in corn, 12,793 acres; in wheat, 4,217 acres; in rye, 1,583 acres; in oats, 1,521 acres; in buckwheat, 175 acres.

Cotton production: 6 bales; average cotton product per acre, 0.38 bale, 534 pounds seed-cotton, or 178 pounds cotton lint.

Jackson county is quite similar to Haywood in its topographical and agricultural features, but is more rugged, and has less open bottom and valley land. It occupies the basin of the Tuckasegee river, a tributary of the Tennessee, lies west of the Balsam mountains, is bounded by the Cowee cross-chain on the west and extends south to the Blue Ridge, and includes a high plateau beyond it of nearly 100 square miles, with an elevation of from 3,500 to 4,000 feet above sea-level. The county is well adapted to the production of grass. The soils, forests, and productions are like those of Haywood. Mica is mined in the county in many places, and gold is found on the plateau south of the Blue Ridge. Of the county area, 8.4 per cent. is under tillage, and of this 0.06 per cent. is in cotton. A railroad has been recently graded across the county.

MACON.

Population: 8,064.—White, 7,395; colored, 669.
Area: 539 square miles.—Woodland, 170,170 acres.
Tilled lands: 32,630 acres.—Area planted in cotton, none; in tobacco, 46 acres; in corn, 14,423 acres; in wheat, 5,565 acres; in rye, 1,823 acres; in oats, 1,621 acres.

Macon county occupies the valley of the Tennessee river, which flows through its center from beyond the Georgia border, on the south, toward the Smoky mountains. This is a wide, open valley, along which are considerable bodies of comparatively level and hilly lands, with extensive bottoms along the river and its principal tributaries, recalling in its general features the basin of the French Broad, though much less extensive. The county is better adapted to the cultivation of grains and has a larger area capable of such cultivation than the neighboring counties; but a large part of its territory is very mountainous, being hemmed in on all sides by high mountain ranges. Along its western side lies the massive chain of the Nantehaleh mountains, with its numerous heavy, ragged spurs, and on the western margin is a deep cañon, drained by the river of the same name. There are two notable plateaus in the south end of the county on the summit of the Blue Ridge, one on the headwaters of the east fork of the Tennessee, and the other on those of the Nantehaleh, both of them ranging from 3,500 to 4,000 feet in altitude.

The larger part of the area of the county is, therefore, better adapted to grazing than to anything else. The soils and forests are like those of the counties above described. The tilled land comprises 9.46 per cent. of the county area. The culture of tobacco has been recently introduced to a small extent, and mica mining is carried on extensively. There are also considerable deposits of iron ore, and the only extensive or profitable corundum mine in this country is found here. The beautiful red marble is found on the Nantehaleh river. A railroad has been recently graded across the northern end of the county.

SWAIN.

Population: 3,784.—White, 3,234; colored, 550.
Area: 445 square miles.—Woodland, 107,825 acres.
Tilled lands: 13,828 acres.—Area planted in cotton, none; in corn, 6,809 acres; in wheat, 1,473 acres; in rye, 515 acres; in oats, 757 acres.

Swain county lies north of Macon and Jackson, along the waters of the Tennessee river, and on the flanks of the great Smoky mountains on the north, which here reach their culmination in elevations of nearly 6,700 feet. With the exception of some open valley tracts near its center along the before-mentioned river and its tributaries, the territory of this county is exceedingly rugged and broken. The proportion of cultivable land is very small. It is heavily timbered, even to the highest summits of the Smoky mountains, with the prevalent mountain forest growths. The higher levels of the Smoky mountains, about 5,000 feet above sea-level, are covered with forests of firs, while the more elevated coves abound in white pine and hemlock, and its deep gorges and lower slopes with maple, poplar, linden, hickory, chestnut, buckeye, walnut, magnolias, and cherry. The summits of the high mountains furnish fine natural pasturage, and grazing has always been the chief industry. The approach of the railroad, which has been graded through its middle section, will speedily develop an extensive lumber interest. The tilled land occupies 4.86 per cent. of the county area.

GRAHAM.

Population: 2,335.—White, 2,123; colored, 212.
Area: 307 square miles.—Woodland, 49,767 acres.
Tilled lands: 8,212 acres.—Area planted in cotton, none; in corn, 4,222 acres; in wheat, 718 acres; in rye, 566 acres; in oats, 628 acres.

Graham county, lying south of the Tennessee river, is bounded on the west by the Smoky mountains and on the south by a high cross-chain called Long Ridge. It resembles Swain county very closely in its physical as well as its agricultural features. Its forests are a continuation of those of Swain, except that the mountains here do not reach the elevation necessary to produce the fir. There is some open valley and hilly land on the Cheowah river and its tributaries, which drains most of its surface. Its population is small, and its agriculture little developed, as there are no accessible markets. Its soils and timber are capable of becoming the basis of thriving industries as soon as the projected Rabun Gap and Knoxville railroad shall be completed. The tilled land occupies 4.18 per cent. of the county area.

CLAY.

Population: 3,316.—White, 3,175; colored, 141.
Area: 189 square miles.—Woodland, 60,606 acres.
Tilled lands: 15,063 acres.—Area planted in cotton, none; in tobacco, 25 acres; in corn, 7,810 acres; in wheat, 3,282 acres; in rye, 854 acres; in oats, 1,230 acres.

The small county of Clay, lying on the southern border, touches the state of Georgia, and is bounded on the east by Macon county, which it resembles very closely in all its features, physical and agricultural, and in its development. It is drained in a westerly direction by the Hiawassee river, which takes its rise in the Blue Ridge, in Georgia. Its eastern section lies upon the high plateau of the upper Nantehaleh river, and on the north lies the chain of the Koneteh mountains. A large part of its territory is very mountainous. It has fine, open valley lands on the river and its tributaries. Its southern section is hilly, somewhat mountainous, with fair agricultural capabilities. Both gold and mica are found, but have not been mined on any considerable scale. The tilled land occupies 12.45 per cent. of the county area.

CHEROKEE.

Population: 8,182.—Whites, 7,796; colored, 386.
Area: 470 square miles.—Woodland, 149,156 acres.
Tilled lands: 28,603 acres.—Area planted in cotton, none; in tobacco, 42 acres; in corn, 14,507 acres; in wheat, 4,317 acres; in rye, 1,126 acres; in oats, 1,534 acres.

Cherokee county occupies the extreme western corner of the state, of which it includes the whole breadth, at this point less than 20 miles. It is bounded in part on the north by the Smoky mountains, and touches the states of Tennessee and Georgia on the west and south. For the most part it resembles Clay county in its soils and agriculture. The valley of the Valley river is open and comparatively level, with extensive bottoms and bordering hilly lands. This valley is nearly 20 miles long and from 3 to 5 miles broad, and contains a large proportion of fine agricultural lands. The forests resemble those of the neighboring counties, and have been sufficiently described. Its agriculture is divided between the culture of grains and grasses and cattle-raising, and mines of gold, iron, and soapstone have been opened and wrought for many years. The iron-ore deposits are of great extent, and there is a great variety of colored marble on Valley and Nantehaleh rivers which needs only transportation to become valuable. The tilled lands occupy 9.51 per cent. of the county area.

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PART III.

CULTURAL AND ECONOMIC DETAILS OF COTTON PRODUCTION.

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G03

REFERENCE LIST

OF

NAMES AND ADDRESSES OF CORRESPONDENTS.

SEABOARD OR TIDE-WATER REGION.

Pasquotank.—E. W. Hallowell, Elizabeth City, February 10, 1880.
Perquimans.—W. Nixon, Winfall, January, 1880.
Chowan.—L. W. Parker, Small Cross-roads, January 6, 1880
Tyrrell.—E. Leigh, Fort Landing, February 24, 1880.
Washington.—J. P. Newberry, Plymouth, January 7, 1880
Beaufort.—R. W. Wharton, Washington, January 10, 1880.
Pamlico.—J. S. Lane, Stonewall, January 29, 1880.
Craven.—C. Duffy, jr., New Berne, March 24, 1880; J. Humphrey, New Berne, January 12, 1880.
Carteret.—A. Oaksmith, Hollywood, February 23, 1880; J. H. Becton, Harlowe, May 26, 1880.
Jones.—H. C. Foscue, Pollocksville, February 15, 1880.
New Hanover.—A. R. Black, Wilmington.
Brunswick.—W. G. Curtis, Smithville, January 9, 1880.
Columbus.—D. S. Cowan, Robeson, January 15, 1880.

LONG-LEAF PINE REGION.

Gates.—J. J. Gatling, Gatlington, March 10, 1880.
Hertford.—D. A. Barnes, Murfreesboro', June 30, 1880.
Bertie.—J. B. Cherry, Windsor, February 24, 1880; E. E. Etheridge, Colerain, April 3, 1880.
Northampton.—J. B. MacRae, Jackson, July 23, 1880.
Halifax.—J. N. Smith, Scotland Neck, June, 1880; R. H. Smith, Scotland Neck, December 18, 1880; J. H. Parker, Enfield, February 6, 1880.
Martin.—William Slade, Williamston, December 24, 1880; J. R. Lanier, Williamston, May 10, 1880.
Pitt.—W. M. B. Brown, Greenville, April 15, 1880; J. Joyner, Marlboro', March 20, 1881.
Greene.—W. E. Best, Snow Hill, January 20, 1880; W. P. Grimsley, Snow Hill, January 30, 1880.
Edgecombe.—W. G. Lewis, Tarboro', April 14, 1880; J. L. Bridgers, Tarboro', March 27, 1880; J. J. Battle, Rocky Mount, April 15, 1880; E. Carr, Old Sparta, January 13, 1880.
Nash.—J. M. Mayo, Whitaker's, June 1, 1880.
Wayne.—J. Robinson, Goldsboro', January 28, 1880.
Johnston.—E. J. Holt, Princeton, March 5, 1880.
Harnett.—H. C. McNeill, Lillington, January 30, 1880.
Moore.—J. C. Campbell, M. D., Carthage; J. M. Joy, Jonesboro', April 15, 1880.
Cumberland.—O. Evans, Idaho, January 1, 1880.
Sampson.—A. A. McKay, Clinton, February 10, 1880.
Duplin.—J. B. Oliver, Faison's, January 30, 1880; J. A. Bryan, Kenansville, June 5, 1880.
Bladen.—D. A. Lamont, Brinkland, February 2, 1880.

OAK UPLANDS REGION.

Granville.—J. W. Hunter, Kittrell's, March 22, 1880; S. P. J. Harris, Henderson, February 6, 1880.
Franklin.—B. Burwell, Louisburg.
Wake.—O. W. Shaffer, Raleigh, January 5, 1880.
Orange.—C. W. Johnston, Chapel Hill, February 16, 1880.
Alamance.—J. A. Graham, Graham, March 1, 1880.
Guilford.—D. W. C. Benbow, M. D., Greensboro', January 29, 1880.
Chatham.—J. F. Rives, Pedlar's Hill, February 2, 1880; R. J. Powell, Pittsboro', February 6, 1880; J. W. Scott, Haywood, January 1, 1880.
Rowan.—J. G. Ramsay, Scotch Ireland, June 14, 1880.
Cabarrus.—J. McDonald, Concord, January 20, 1880.
Anson.—W. A. Liles, Wadesboro', March 8, 1880.
Union.—H. M. Houston, Monroe, January 30, 1880.
Mecklenburg.—W. E. Ardrey, Pineville, February 18, 1880; R. I. McDowell, Charlotte, March 25, 1880.
Gaston.—J. Stowe, Lowell, January 27, 1880.
Lincoln.—W. A. Graham, Iron Station, February, 1880.
Cleaveland.—E. P. Chambers, Stice's Shoal, March 24, 1880; J. B. Logan, Shelby, March 2, 1880.
Alexander.—W. P. Burke, Taylorsville, June 24, 1880.

SUMMARY OF ANSWERS TO SCHEDULE QUESTIONS.

This part of the report embraces a summary of the answers given to each question or group of questions included in schedules sent to farmers in different parts of the cotton region of the state. Forty-eight of the counties in which cotton is grown are here represented.

When a special answer is given, the name of the county from which it comes is put in italics, and separated by semicolon.

TILLAGE, IMPROVEMENT, ETC.

1. Usual depth of tillage (measured on land-side of furrow): What draft is employed in breaking up?

From 3 to 6 inches in the great majority of counties throughout the state. From 2 to 3 inches in Perquimans, Jones, Columbus, Guilford, Cabarrus, and Martin. In breaking up, 8 inches in Chowan, Beaufort, Lincoln, and Moore. The draft employed is usually one or two horses or mules. *Beaufort:* Double teams on large farms.

2. Is subsoiling practiced? If so, with what implements, and with what results?

It is not practiced in fourteen counties of the coast and long-leaf pine regions and in Granville county, of the oak upland region. To a small extent in all other counties except Beaufort, Anson, Union, Edgecombe, and Harnett, where the custom is more prevalent. Murphy's subsoil plow is used in several counties; in others either the bull-tongue, colter, or shovel plow. Results are excellent everywhere except in Orange, Alamance, Lincoln, Halifax, Martin, Jones, Moore, and Duplin.

3. Is fall plowing practiced? With what results?

Not at all in Dare, Carteret, Jones, Wake, Northampton, Greene, and Harnett; very little in twenty-six counties, and to a large extent in the rest. Results are good in all but four counties, especially on stiff or heavy land in Beaufort, Halifax, and Nash; not much better than spring plowing in Union.

4. Is fallowing practiced? Is the land tilled while lying fallow, or only "turned out"?

In twenty-eight counties fallowing with tillage is not practiced, the land only being "turned out". In Granville, Franklin, Orange, Guilford, Rowan, Cabarrus, Alexander, and Pitt the lands are tilled while lying fallow. In Chowan only "turned out" when very rough. In a few other counties fallowing is practiced to a small extent. Results are not given.

5. Is rotation of crops practiced? If so, of how many years' course, in what order of crops, and with what results?

In eighteen counties rotation is either not practiced at all or to a very small extent, cotton being planted continuously from year to year; usually, in three years' course, corn and small grain and pease or potatoes following cotton. No regular order prevails; results are generally good for cotton, except in Alamance and Martin. In Guilford corn impoverishes but wheat improves the land. In Lincoln cotton is planted two or three years, and then corn one year.

6. What fertilizers, or other direct means of improving the soil, are used by you, or in your region? Is green-manuring practiced? With what results?

The use of commercial fertilizers is reported from twenty-eight counties, and in ten of these no other fertilizer is mentioned. In all other counties composts of stable manure, with other material, such as leaves, muck, lime, ashes, cottonseed, etc., are in general use. Marls are put on the land in Pamlico, Craven, Columbus, Pitt, Edgecombe, Duplin, and Bladen. In some of the counties commercial fertilizers alone are thought to be unprofitable. *Green-manuring* is not practiced to any extent in twenty-four counties; in others, cow-pease, grass, and sometimes clover are turned under, and yield good results, except in Duplin, where "there is no marked benefit".

7. How is cottonseed disposed of? If sold, on what terms, or at what price? Is cottonseed-cake used with you for feed?

In thirty-six counties the seed is used or sold only for manure, while in the others it is partly fed to stock for feed. Its price is from 10 to 12½ cents per bushel. Cottonseed-cake is not used in any of the forty-three counties from whence answers were received, except Wake, where very little is fed to cows.

PLANTING AND CULTIVATION OF COTTON.

8. What preparation is usually given to cotton land before bedding up?

In seven of the counties no preparation is given the land before bedding up. In twenty-four counties spring plowing is done; in nine counties fall or winter plowing is practiced sometimes. The old stalks are usually plowed under. *New Hanover:* The land is well broken, and sometimes subsoiled. *Moore:* Fall plowing is best for stubble land, spring plowing for hard gravelly land; but no preparation is necessary for a sandy or clay soil.

9. Do you plant in ridges? How far apart?

Cotton is planted in drills only in Greene county. In all others ridges are usually preferred. A distance of from 3 to 4 feet between the ridges is the almost universal width, Granville, Alamance, Franklin, and Greene alone giving a less distance.

10. What is your usual planting time?

The earliest dates given are March 15 in Carteret, and April 1 in Rowan, April 10 in Pamlico and Cabarrus, April 15 to 25 in thirty-one counties, May 1 in eleven counties, and May 15 in Union. The longest planting season given is in Carteret—March 15 to June 1.

11. What variety do you prefer? How much seed is used per acre?

There are fifteen varieties of cotton mentioned, and in a majority of counties no preference is expressed between several of the varieties. The Dixon is, however, most generally planted, its name appearing in twenty-three counties. The Johnson is mentioned six times, Boyd's, Peeler, and Simpson varieties three times, Sugar-Loaf twice, and Matagorda silk, Clinton, Petit Gulf, and others once each.

In twenty-four counties, from 1 to 2 bushels; in seventeen counties, sometimes as much as 3 bushels; and six counties, occasionally 4 bushels. *Chowan:* From one-half to 1 bushel.

12. What implements do you use in planting? Are "cottonseed planters" used in your region? What opinion is held of their efficacy or convenience?

In twenty-nine counties cotton-planters are used either of some patent or home-made. A harrow usually precedes the planter, and sometimes a drill is made. In other counties (fourteen) the row is opened with a plow, the seed dropped by hand, and covered with a board attached to a plow-stock. In all but five counties cotton-planters, where used, are in great favor; "they save labor, are convenient, plant regularly, and economize seed." *Anson:* Liked where land is not too rough. *Columbus:* Not entirely reliable, though convenient.

13. How long usually before your seed comes up?

For favorable season the time is put at from 3 to 5 days in fourteen counties, from 6 to 8 days in nineteen counties, 9 to 10 days in eight counties, 14 days in Orange and Lincoln, and 14 days, if soaked before planting, in Alamance. In unfavorable weather it sometimes is from 21 to 30 days before the plant appears in Perquimans, Chowan, Pamlico, Carteret, Cabarrus, Lincoln, and Pitt counties.

14. At what stage of growth do you thin out your stand, and how far apart?

In twenty-eight counties, when the plant is well up or from 2 to 4 leaves have appeared, or when from 3 to 6 inches above ground. When plants are from 10 to 15 days' old in Washington, Brunswick, Granville, Orange, Chatham, Gates, Harnett, and Cumberland. After 21 days in Bladen; when 6 weeks' old in Pamlico. One or two plants are left standing at from 12 to 15 or 18 inches apart in the majority of counties; 6 to 8 inches in Wake, Alamance, Rowan, Cabarrus, Mecklenburg, Alexander, and Greene; 24 inches in Orange.

15. Is your cotton liable to suffer from "sore-shin"?

In ten counties, mostly in the coast region, the disease is not known; in twelve others it seldom appears, while in twenty-two it is very prevalent. *Craven, Granville,* and *Edgecombe:* Only when bruised with the hoe. *Washington, Beaufort, Wake, Cabarrus, Mecklenburg, Cleaveland, Gates, Bertie,* and *Bladen:* In wet, cold weather. *Pitt:* When spring winds are high.

16. What after-cultivation do you give, and with what implements?

Northampton and *Halifax:* Bar off, chop out grass with hoes, then use a very small plow to throw the dirt back to the plant; then use only cotton plows. *Martin* and *Nash:* Run along close to the cotton with a fine-toothed harrow; then chop out and side up with a sweep.

Twelve counties use scraper, turn-plows, sweeps, and cultivators, usually going over the field three or four times and chopping out the grass between plants with a hoe. Fourteen counties use sweeps and hoes only, giving a shallow cultivation. *Cleaveland:* Use the bull-tongue plow, harrow, and hoe. *Hertford:* Use cotton plow, weeding-hoe, and sweeps; work the land about every 10 days.

17. What is the height usually attained by your cotton before blooming?

From 6 to 8 inches in Franklin and Harnett; from 12 to 18 inches in most of the other counties. *Pasquotank, Perquimans, Dare, Beaufort, New Hanover, Brunswick* (of the coast), *Pitt, Cumberland, Sampson,* and *Bladen* (long-leaf pine region), and *Orange, Chatham,* and *Lincoln* (oak uplands), from 24 to 30 inches.

18. When do you usually see the first blooms?

Beaufort, Pamlico, Craven, Anson, Mecklenburg, Lincoln, Wayne, Johnston, and *Bladen:* June 25 to 28. All other counties July 1 to 10, except *Columbus* and *Guilford,* where August and September are given as the dates.

19. When do the bolls first open?

July 15 in *Wayne;* August 1, *Pamlico, Carteret, Franklin, Rowan,* and *Cleaveland;* August 10 to 15, in *Chowan, Washington, Beaufort, Craven, Gates, Northampton, Martin, Nash, Harnett, Cumberland, Bladen Chatham, Anson,* and *Gaston.* From August 15 to September 1, in all other counties, except *Columbus,* in which October is named.

20. When do you begin your first picking?

September 1 in *Chowan, Washington, Beaufort, Carteret, Craven,* and *Brunswick* (coast region), *Gates, Martin,* and *Wayne* (long-leaf pine), *Franklin, Orange, Chatham, Cabarrus, Anson, Gaston,* and *Cleaveland* (oak uplands); September 10 to 15 in twenty-one counties. From September 15 to October 1 in all other counties, except *Columbus,* in which the first picking is made in the latter part of October.

21. How many pickings do you usually make, and when? Do you ordinarily pick all your cotton?

Two pickings in Chowan, Pamlico, and Guilford; four in Wake, Cabarrus, Northampton, and Duplin, in September, October, November, and December. Three pickings usually in all other counties during September, October, and November, or from two to four weeks apart. In all of the counties, except Bladen, the cotton is usually all gathered.

22. At what date does picking usually close?

November 1 in Guilford; November 15 in Dare; December 1 in Washington, Franklin, Orange, Alamance, Chatham, Union, Cleaveland, Pitt, Wayne, Harnett, Sampson, and Bladen; December 10 or 15 in sixteen counties; from December 15 to January 1 in all others.

23. At what time do you expect the first "black frost"?

October 1 in Alexander; October 10 or 15 in Beaufort, Craven, Carteret, New Hanover (coast region), Bertie, Martin, Greene, Edgecombe, Nash, Harnett (long-leaf pine), Granville, Franklin, Orange, Alamance, Chatham, Anson, Union, Mecklenburg, Gaston, Lincoln, Cleaveland (oak uplands); from October 15 to November 1 in nineteen counties; November 10 or 15 in Pamlico, Columbus, Northampton, and Bladen.

24. Do you pen your seed-cotton in the field, or gin as the picking progresses?

In no county is it reported as penned in the field. In fourteen counties it is housed mostly in the gin-house until each picking is over, or till time can be had for ginning. In all other counties cotton is ginned as the picking progresses. *Anson:* Large planters gin as picking progresses; others only when convenient.

GINNING, BALING, AND SHIPPING.

25. What gin do you use? How many saws? What motive power? How much clean lint do you make in a day's run of 10 hours? Which mechanical "power" arrangement do you prefer with horse-power?

There are 14 different gin patents in use in the state as far as reported. Of these the Brown is mentioned in 25 counties, the Georgia in 12, the Hall in 8, the Taylor in 4, Emery in 3, and others in 1 or 2 counties each. These are the Carver, Needle, Carolina, Carter, Clements, Griswold, Rowland, Massey, and Excelsior. The number of saws vary from 40 to 100 in each gin. The motive power is steam, water, and horses or mules; but a preference for steam is reported in 16 counties, for water in 5 counties, and for mules in 1 county. The following capacity of each gin in ten hours' run with the different powers is given:

Brown's gin of 40 saws, with 4 horse-power, steam, will make 1,875 pounds; 40 saws, with 12 horse-power, steam, 4,000 pounds; 45 saws, with horse-power, 1,600 pounds; 50 saws, with horse-power, 1,600 pounds; 50 saws, with steam, from 2,000 to 4,000 pounds; 60 saws, with water, 3,125 pounds; 70 saws, with water, 3,500 pounds.

Georgia gin of 30 saws, with 3 mules, will make 2,000 pounds; 35 saws, with 2 mules, 1,200 pounds; 40 saws, with water, 1,500 pounds; 50 saws, with mules, from 1,000 to 2,000 pounds; 50 saws, with 10 horse-power engine, 5,000 pounds; 60 saws, with water, 3,000 pounds.

Hall's gin of 50 or 60 saws, with steam, from 3,000 to 4,000 pounds.

The Needle gin of 50 saws, with 8 horse-power engine, 2,000 pounds; 50 saws, with 10 horse-power engine, 5,000 pounds.

Rowland's Carolina gin of 50 saws, with water-power, 4,000 pounds.

Emery's gin of 50 saws, with steam, from 3,000 to 4,000 pounds; 50 saws, with water, 2,500 pounds.

Taylor's gin of 40 saws, with horse-power, 1,000 pounds.

As a "power" arrangement with mules or horses we prefer that made here; it has a large driving-wheel, cog-gearing, and band-wheel (*Pasquotank*).

26. How much seed-cotton, on an average, is required for a 475-pound bale of lint?

In most of the counties 1,425; sometimes 1,310 in Columbus, Pasquotank, and Edgecombe; 1,450 in Alamance; 1,485 in Pamlico, Craven, Cleaveland, Northampton, and Harnett; 1,515 in Halifax; 1,545 in New Hanover and Gates; 1,660 in Wake and Orange.

27. What press is generally used in your region for baling? What is its capacity?

In many of the counties home-made screws are in use. There are fifteen patented iron screw presses reported, Ball's and Brooks' being mentioned six times each, Cockade three times, and the following once or twice each: Caldwell, Centennial, Dixie, Boss, Roanoke, Godwin's, Eclipse, Beasley, Cotton King, Compass, Hart's, and Southern Standard. Their capacity is from 10 to 15 bales per day, or about 1 bale per hour. "The Cotton King will, with three men, pack a bale in ten minutes" (*Harnett*).

28. Do you use rope or iron ties for baling? If the latter, what fastening do you prefer? What kind of bagging is used in your region?

Iron ties only are used throughout the state, with arrow, buckle, and anchor fastenings. The arrow is the most popular fastening.

Gunny bagging is used in thirteen counties. Jute, double anchor and arrow, Kentucky, Dundee, and Standard are used in other counties; also the "domestic", manufactured at Richmond.

29. What weight do you aim to give your bales? Have transportation companies imposed any conditions in this respect?

Four hundred pounds in Brunswick, Alamance, and Cumberland; from 450 to 500 pounds in all other counties. In most of the state "no conditions" are imposed. *New Hanover, Nash, Halifax, Duplin:* Additional freight is charged if over 450 pounds. *Cleareland:* The Carolina Central railroad averages bales at 400 pounds. *Sampson:* Extra charges are made for over 500 pounds weight. *Mecklenburg, Greene, Wayne:* $1 is deducted from the price of each bale below 400 pounds weight.

DISEASES, INSECT ENEMIES, ETC.

30. By what accidents of weather, diseases, or insect pests is your cotton crop most liable to be injured? At what dates do these several pests or diseases usually make their appearance? To what cause is the trouble attributed by your farmers?

The caterpillar appears in ten counties of the coast region; in Pitt, Nash, Johnston, Sampson, and Bladen, of the long-leaf pine region; and in Guilford and Rowan, of the oak uplands. It usually comes in August and September in these counties, except in Beaufort and Johnston. There it appears in October, too late to do any damage. *Lincoln:* The caterpillar has been here twice in fifteen years, coming late in the season and doing as much good as harm by eating the leaves, thus letting in the sun and causing cotton to open.

The boll-worm is only reported in Perquimans, Jones, Pitt, Harnett, Bladen, Guilford, and Rowan counties, and usually appears in August.

The cut-worm causes damage in Pitt and Duplin counties in May.

Cotton-lice in Pasquotank, Carteret, Pitt, Edgecombe, Wayne, and Johnston counties in June and July.

Shedding causes much damage in all of the counties except New Hanover, Columbus, Alamance, Union, Gaston, and Wayne, where no mention is made of it. It is generally attributed to droughts after excessive rains in the spring.

Rot of bolls is complained of in all of the counties except Perquimans, Pasquotank, Carteret (coast region), Gates, Hertford, Northampton, Pitt, Nash, Wayne, Johnston, Harnett, Duplin (long-leaf pine region), Granville, Franklin, Cabarrus, Anson, Lincoln, Cleaveland, and Alexander (oak uplands). It is usually attributed to wet weather. *Moore:* Caused by water penetrating the holes made by the boll-worm.

Rust is reported in all of the counties except Dare, Carteret, Granville, Lincoln, Alexander, and Martin. It is usually attributed to "bad weather". *Union:* Cold nights followed by heavy dews. *Halifax:* Black rust in wet and red rust in dry seasons, and attributed to bad drainage, cold nights, heavy dews, and want of fertilizers. *Pitt, Anson,* and *Duplin:* To want of manure, potash in vegetable matter in the soil. *Moore:* To unsuitable soils. *Sampson:* A want of salt in the manure. *Beaufort:* On badly drained and poor land, or in soils having too much iron.

Blight is reported from only nineteen counties, attributed mostly to bad weather.

31. What efforts have been made to obviate the trouble, and with what success?

None in twenty counties.

High fertilization, good culture, and thorough drainage is practiced against rust and shedding in Perquimans, Beaufort, Gates, Hertford, Bertie, Martin, Pitt, Greene, and Moore, with fair success in most cases. *Beaufort* and *Craven:* Wood ashes are used against rust. *Craven:* Acid phosphate to keep bolls from rotting. *Carteret:* Lime and salt, with some success. *Anson:* Subsoiling for shedding and potash for rust, with indifferent success. *Lincoln:* Deep plowing against rust. *Halifax:* Ditching and application of vegetable matter, except for rust, against which no remedy has been found. *Edgecombe:* Ditching and kainit, also marling, greatly modifies black rust. *Nash:* Salt and sulphate of potash produce fine results. *Duplin:* Rotation of crops, fallowing, and applying vegetable matter, or using muriate of potash, from 30 to 50 pounds per acre, with other manure, meet with marked success.

32. Is rust or blight prevalent chiefly on ill-drained soils? Do they prevail chiefly in wet, cool seasons? On which soil described by you are they most common?

COAST REGION: Most common on the heavy and ill-drained soil of the low, black swamp land in cool and wet weather, in Pasquotank, Chowan, Washington, Beaufort, and Carteret. Most common when land is poorest after heavy cool rains in Tyrrell and Brunswick; on heavy and ill-drained soils in wet, hot seasons in Jones; on ill-drained gray loam soil with clay subsoil in New Hanover. "I have seen it in low, wet bottoms, and within 3 feet of a ditch in wet and dry seasons, and hot and cool weather" (*Perquimans*).

LONG-LEAF PINE REGION: On ill-drained soils in all the counties. In wet and cool seasons in nine counties; in wet and hot seasons in three counties; in dry and cool in three counties. Most common on lowlands in five counties, and on light sandy soils with stiff clay subsoils in most of the region. *Moore:* The farmers of the red sandstone region nearly all affirm that their cotton is not much subject to rust, disease, or other pest.

OAK UPLANDS: On ill-drained soil; sometimes on heavy clay soils; sometimes on light sandy soils with an impervious subsoil; on black-jack oak soil in Cabarrus. On the red or hickory soils (Gaston), "which suffers all the ills." In wet and hot seasons in Anson; dry and hot seasons on land where stable manure has been applied alone in Lincoln; wet and cool seasons in other counties.

33. Is Paris green used as a remedy against the caterpillar; if so, how, and with what effect?

Craven: Yes; sprinkled over the plants with good success. *Brunswick:* Yes, but with poor effect. *New Hanover:* Yes, but the caterpillar is not troublesome. Paris green has not been used in any other county to any extent.

LABOR AND SYSTEM OF FARMING.

34. What is the average size of farms or plantations in your region? Is the prevalent practice "mixed farming" or "planting"?

COAST REGION: From 1 to 20 acres in Dare; from 60 to 200 in Chowan, Pasquotank, Jones, and Carteret; 150 in Beaufort; from 30 to 300 in Craven; from 50 to 500 in Perquimans, Tyrrell, and Pamlico; from 100 to 1,000 in Washington. The practice is entirely "mixed farming".

LONG-LEAF PINE REGION: From 30 to 60 acres in Gates, Moore, Martin, and Sampson; from 50 to 150 in Hertford, Greene, Harnett, and Bladen; from 300 to 500 acres in other counties. The practice is altogether "mixed farming".

OAK UPLANDS: From 50 to 100 acres in Orange, Chatham, Anson, Union, Gaston, and Alexander; from 50 to 200 in Franklin, Alamance, Guilford, Rowan, Cabarrus, and Cleaveland; from 50 to 300 in Granville, Wake, Mecklenburg, and Bertie; from 50 to 6,500 acres in Lincoln. The practice is "mixed farming", except in Wake, where "planting" is chiefly done.

35. Are supplies raised at home or imported, and if the latter, where from? Is the tendency toward the raising of home supplies increasing or decreasing?

Brunswick, Wake, Bertie, and *Northampton:* Mostly imported from Baltimore and Cincinnati. *Carteret* and *Hertford:* About one-half raised at home. *Gaston* and *Edgecombe:* Partly at home. *Nash:* We import a great deal of meat, flour, sugar, corn, tea, etc. In all other counties supplies are mostly raised at home. Some bacon is purchased elsewhere. The tendency toward raising home supplies is increasing in all of the counties except Rowan and Anson, where it is said to be "*stationary*".

36. Who are your laborers chiefly? whites, of what nationality?

In Chowan county alone white laborers predominate. In twenty-seven counties negro laborers are most numerous, while in the rest the laborers are thought to be about evenly divided between the two races.

37. How are their wages paid; by the year, month, day; and at what rates? When payable?

In a majority of the counties of the state laborers receive from $8 to $10 per month, and from $80 to $100 per year, with rations, house, and fuel, or from 40 to 50 cents per day, without rations. In others the rates are from $6 to $8 per month, with rations, from 30 to 40 cents per day, or $75 per year. Women and children receive usually about $5 per month, with board. Wages are usually paid at the end of a specified time, either the month, week, or day; sometimes when cotton crops are sold.

38. Are cotton farms worked on shares? On what terms? Are any supplies furnished by the owners?

The share system is in general practice throughout the cotton counties, the counties of Alexander, Pasquotank, and Guilford alone reporting "no", while a few reply "to some extent". When the owner furnishes all necessary supplies, except food for the laborer, and one-half of any fertilizers that may be used, the crop is equally divided between the owner and laborer. For land alone, without supplies, the owner receives one-third of the corn and one-fourth of the cotton.

39. Does your system give satisfaction? How does it affect the quality of the staple? Does the soil deteriorate or improve under it?

It does not give satisfaction in Perquimans, Craven, Jones, Guilford, Harnett, and Bladen. "Hard to say" in Pamlico, Franklin, and Edgecombe. "Yes" in all the others.

The *staple* is improved in Washington; is not so good in Gates, and is not affected in other counties. The soil is not affected in Perquimans, Alexander, and Pitt; "improves if properly manured and cultivated" in eleven counties, but "deteriorates" in all others.

40. Which system (wage or share) is the better for the laborer, and why?

Pamlico, Craven, Granville, and *Pitt:* But little difference either way, as they accumulate but little. *Greene:* Shares for the married and wages for the single, because the former make more and the latter are idle less.

Wages in thirty-one counties for following reasons: Laborers receive cash monthly; are better clothed and fed; cultivate with better judgment and have fewer failures in crops, and crops are not neglected; for them there are no contingencies; negroes are extravagant, exercise no forethought, and need intelligent direction; they need not run in debt; their condition requires a regular income.

Shares in eleven counties: Laborers are provided for during winter months; they spend wages as fast as obtained. They can make more with proper work; gives a living at home and children can be made useful; take better care of the crop and are less wasteful.

41. What is the condition of the laborers?

In thirty-four counties "good" and mostly improving. In eight counties "poor". *Gaston:* Not good, but truly happy. *Lincoln:* Improved some, but not much. *Wayne:* Considerably demoralized. *Sampson:* Happy, if let alone by politicians. *Jones:* Not as good as we would wish. *Hertford:* Live well, but are improvident.

42. What proportion of negro laborers own land, or the houses in which they live?

Columbus: About 90 per cent. *Dare:* About two-thirds. *Tyrrell* and *Beaufort:* One-fourth. *Craven* and *Chatham:* One-fifth. *Gaston, Greene, Sampson:* One in eight or ten. *Pamlico, Wake, Cleaveland, Alexander, Martin, Moore, Cumberland,* and *Bladen:* One in twenty. *Chowan, Franklin, Union, Pitt, Edgecombe,* and *Wayne:* One in fifty. *Pasquotank, Perquimans, Alamance, Rowan, Johnston,* and *Duplin:* "One in a hundred." In other counties, "very few."

43. What is the market value of the land described in your region? What rent is paid for such land?

COAST REGION: *Perquimans, Chowan, Pamlico,* and *Jones:* From $10 to $15 and $20 value; from $3 to $5 as rent per acre. *Pasquotank, Washington, Beaufort, New Hanover,* and *Columbus:* Value, from $5 to $8 and upward; rent, from $2 to $5 per acre. In other counties values and rents from $2 and upward.

LONG-LEAF PINE REGION: *Pitt, Greene, Edgecombe,* and *Cumberland:* Value, from $10 to $20; other counties, from $2 to $7 and upward. Rents, from $1 50 to $5 per acre.

OAK UPLANDS REGIONS: *Granville, Wake, Anson, Union, Mecklenburg,* and *Gaston:* Value, from $10 to $20 and $30 per acre; rents, from $2 to $5 per acre. *Franklin, Orange, Alamance, Rowan, Cabarrus, Lincoln,* and *Alexander:* Value, $5, $7, $8 and upward; other counties, from $2 to $4 and upward. Rents, from $2 to $4 per acre.

In all of the cotton counties portions of the crop are taken as rent. (See No. 41.) *Franklin:* 800 pounds lint cotton for 25 or 30 acres.

44. How many acres, or 400-pound bales, per "hand" is your customary estimate?

From 10 to 15 acres of cotton, besides the same amount of land in other crops; or from 25 to 30 acres alone in cotton. The number of bales of cotton varies according to the character of land cultivated, but is usually from 5 to 7 bales with other crops, or from 8 to 10 if cotton alone is planted. For picking this amount extra hands have to be employed. In Craven, Granville, Anson, Gates, Bertie, Moore, Cumberland, and Sampson but 3 or 4 bales are estimated per hand with other crops.

45. To what extent does the system of credits or advances upon the growing cotton crop prevail in your region?

Very little in Columbus, Guilford, Chatham, and Alexander. To a considerable extent in Brunswick, Rowan, Anson, Union, Cleaveland, Cumberland, and Duplin. Not too much in Pamlico. To value of one-half of the crop on an average in Carteret, Franklin, Mecklenburg, and Wayne. Only for fertilizers in Alamance. In other counties the system prevails to a great extent, and in several "almost universally". *Wake:* Most farmers do not clear enough one year to enable them to grow the next year's crop. The system is "blue ruin" to the farmer. *Craven:* The merchants and others who furnish supplies take advantage by charging extortionate prices. *Lincoln:* Not much among those farmers doing their own work, but is almost universal among those who hire. *Edgecombe, Pitt, Beaufort:* The practice is decreasing every year.

46. At what stage of its production is the cotton crop usually covered by insurance? Is such practice general?

From March to November in Gaston. It is generally insured when in the gin-house in Franklin, Edgecombe, and Sampson, and sometimes in Pasquotank, Perquimans, Chowan, Craven, Jones, Martin, Pitt, Moore, and Cumberland; when ready for shipment in a few counties, but not at all in the others until the cotton has passed out of the hands of the farmer.

47. What are the merchants' commissions and charges for storing, handling, shipping, insurance, etc., to which your crop is subject? What is the total amount of these charges against the farmer per pound or bale?

Commissions, from 2½ to 3 per cent.; storage, 25 cents per month; wharfage, 20 cents; weighing, from 10 to 15 cents; drayage, 10 cents in New Hanover, 15 cents in Carteret, 63 cents in Halifax; handling, 30 cents in Hertford, 75 cents in Halifax; insurance, ¼ per cent. in New Hanover, 25 cents in Carteret, Franklin, Gates, and Nash; 50 cents in Hertford; total charges, about 1 cent per pound to reach Baltimore or New York, or from ¼ to ¼ cent per pound to Norfolk, including freight from Beaufort and Pasquotank; 1 cent to Norfolk, and 1¼ cents per pound to New York from Pitt, Edgecombe, and Nash; to Wilmington from Columbus county, $1 50 per bale. In other counties the usual estimate is $2 per bale, except at local markets, where farmers sell direct to buyers, and avoid other charges than weighing, or, perhaps, commission.

48. What is your estimate of the cost of production in your region, exclusive of such charges, and with fair soil and management?

From 5 to 6 cents per pound in Chowan, Carteret, Bertie, Gaston, and Duplin; from 7 to 8 cents in twenty-four counties; from 8 to 9 cents in eight counties; 10 cents in Dare, Pamlico, Granville, and Gates; $5 per acre in Guilford; $10 in Alexander; $12 in Granville; 2 per cent. in Perquimans; from 50 to 60 per cent. in Rowan.

Alamance: 8 cents per pound; at 10 cents it pays better than corn at $1 per bushel.

Cabarrus (a): Determined to ascertain what it cost a pound to grow cotton, I commenced in 1878 to keep an accurate field account. To be certain that the year 1878 was not an exceptional year as to cheapness of labor, etc., I continued the account the following year. The quantity of land in cultivation was 22 acres and over; the same tract both years. The preparation of the ground and after cultivation was probably more thorough than are usually given for this crop.

1878. Dr.

To preparing ground, planting seed, putting in fertilizers, bringing to a stand, hoeing, and cultivation	$99 65
To cost of fertilizers (cash)	110 97
To picking 21,984 pounds of seed-cotton	98 01
To interest on capital	72 00
To taxes	8 00
To bagging and ties	14 00
To transportation	10 00
	412 63
Less the value of seed	56 25
	356 38

1878. Cr.

By 7,087 pounds baled cotton sold	637 83
Net profit	281 45

Items.

Cost of cotton per pound, 5.3 cents.	
Expense per acre, exclusive of fertilizers	$11 63
Net return per acre	12 32
Average price received per pound, 9 cents.	
Yield of seed-cotton per acre, 999.8 pounds.	

1879. Dr.

To preparing ground, putting in fertilizer, planting, bringing to a stand, hoeing, and cultivation	$97 34
To 40 bushels seed, at 12½ cents per bushel	5 00
To fertilizers (cash)	92 12
To blacksmithing	3 00
To picking 22,013 pounds of seed-cotton	90 69
To bagging and ties	15 00
To interest on capital	72 00
To taxes	8 00
To transportation	10 00
	393 15
Less the value of seed	56 25
	336 90

1879. Cr.

By 7,317 pounds baled cotton sold	813 19
Net profit	476 29

Items.

Cost per pound, 4⅝ cents.	
Expense per acre, including fertilizers	$15 32
Profit per acre	21 65
Average price received per pound, 11.11 cents.	
Yield of seed-cotton per acre, 1,000⅑ pounds.	

It will be observed from an examination of the foregoing statements that the cost per pound in growing cotton must depend upon the yield per acre; that the product per acre is the measure of the planter's profit; that the cost of cultivation, etc., of an acre is the same when yielding 500 pounds or less of seed-cotton, as when yielding 1,000 pounds or more, saving the additional cost of picking, which is fully counterbalanced by the gain in seed, and that there can be no profit when the product of an acre fails to realize the farmer or planter more than $12.

Cost of picking: The usual price paid is 50 cents per 100 pounds without board, or 40 cents with board. *Beaufort:* In the first of the season, when cottonseed is heavy, the price paid is 40 cents; in the middle of the picking season, 50 cents; in the latter part of the season, when cotton and seed are light, from 60 cents to $1 per 100 pounds. The average amount picked is 140 pounds. *Duplin:* An ordinary hand can average about 100 pounds per day; under favorable circumstances some pick as much as 200 pounds. It is usual to pick the cotton fields over two or three times, which is one reason why as much is not gathered as farther south. *Alamance:* Hands are paid 50 cents per 100 pounds with board, or 75 cents without board. An ordinary hand can pick only 100 pounds per day. *Northampton:* An ordinary hand can only pick 75 pounds of cotton per day

a The estimate from Cabarrus county was made by C. McDonald, of Concord.

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REPORT

ON THE

COTTON PRODUCTION OF THE STATE OF VIRGINIA,

WITH A BRIEF DISCUSSION OF

THE GENERAL AGRICULTURAL FEATURES OF THE STATE.

BY

W. C. KERR, PH. D.,
STATE GEOLOGIST OF NORTH CAROLINA,
SPECIAL AGENT.

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ANN ARBOR, MICH.
No.....

LETTERS OF TRANSMITTAL.

BERKELEY, CALIFORNIA, *June* 1, 1883.

To the SUPERINTENDENT OF CENSUS.

DEAR SIR: I transmit herewith a report, by Professor W. C. Kerr, on cotton production in the state of Virginia, with a description of the agricultural features of the cotton-growing counties, a corresponding map of the same being attached to that of the state of North Carolina.

In the case of Virginia, as in that of the other border states, the cotton-growing area seems to be in process of concentration upon the lands where climate and soil concur in rendering possible the competition with the cotton states proper. Hence it has not been deemed important to include the whole of the state in the agricultural description in connection with the subject-matter of these reports.

Very respectfully,

E. W. HILGARD,
Special Agent in charge of Cotton Production.

Dr. EUGENE W. HILGARD,
Special Agent in charge of Cotton Culture.

DEAR SIR: I have the honor to transmit herewith my report on the cotton production of Virginia. I have followed your Louisiana report in the general plan, modifying it only so far as seemed to be demanded by the fact that only a small part of the state of Virginia produces cotton. I have given—

1. Tables of acreage and production of leading crops.
2. A description of the physical geography.
3. A description of the agricultural regions.
4. A general discussion of cotton production in the state.
5. Description of the cotton-growing counties in the several agricultural regions, with abstracts of the schedules of cotton production in the several counties from which such reports were received.
6. Abstracts of the schedule answers to questions regarding methods of cultivation, markets, etc.

The sources of information for this paper are: First, personal observations in most of the cotton-growing counties and in various parts of the state; second, and chiefly, Hotchkiss' *Virginia: A Geographical and Political Summary;* third (for climate in part), publications of the United States signal service.

Yours, very respectfully,

W. C. KERR.

TABULATED RESULTS OF THE ENUMERATION

IN THE

COTTON-GROWING COUNTIES OF VIRGINIA.

TABLE I.—AREA, POPULATION, TILLED LAND, AND COTTON PRODUCTION.
TABLE II.—ACREAGE AND PRODUCTION OF LEADING CROPS.

TABLE I.—AREA, POPULATION, TILLED LAND, AND COTTON PRODUCTION.

Counties.	Area.	POPULATION.						TILLED LAND.			COTTON PRODUCTION.					Cotton acreage per square mile.
		Total.	Male.	Female.	White.	Colored.	Average per square mile.	Acres.	Per cent in cotton.	Per cent. of county area.	Acres.	Bales, 475 lbs.	AVERAGE PER ACRE.			
													Bales.	Seed cotton.	Lint.	
	Sq. mls.													*Lbs.*	*Lbs.*	
Total for the State	40,125	1,512,565	745,589	766,976	880,858	631,707	38	7,358,030	0.61	28.65	45,040	19,595	0.44	621	207	1.12
Total for cotton counties	4,420	157,699	77,565	80,134	63,663	94,036	36	773,611	5.82	27.35	45,040	19,595	0.44	621	207	10.19
TIDE-WATER REGION.																
King and Queen	360	10,502	5,059	5,443	4,424	6,078	29	91,086	0.09	39.53	80	20	0.25	357	119	0.22
Prince George	300	10,054	5,098	4,956	3,255	6,799	34	59,243	3.21	30.86	1,900	700	0.37	525	175	6.33
Sussex	400	10,062	5,074	4,988	3,361	6,701	25	54,989	8.73	21.48	4,800	1,950	0.41	579	193	12.00
Isle of Wight	290	10,572	5,449	5,123	6,010	4,562	36	50,756	1.67	27.35	850	400	0.47	672	224	2.93
Nansemond	400	15,903	8,062	7,841	7,728	8,175	40	57,651	3.40	22.52	1,960	800	0.41	582	194	4.90
Southampton	610	18,012	8,905	9,017	7,447	10,565	30	107,269	10.72	27.48	11,500	5,200	0.45	645	215	18.85
Greensville	330	8,407	4,232	4,175	2,757	5,650	25	42,556	19.97	20.15	8,500	4,100	0.48	687	229	25.76
Total	2,690	83,512	41,969	41,543	34,982	48,530	31	463,550	6.38	26.93	29,590	13,170	0.45	633	211	11.00
OAK UPLANDS REGION.																
Dinwiddie	540	32,870	15,484	17,386	14,437	18,433	61	85,408	7.61	24.71	6,500	2,500	0.38	549	183	12.04
Mecklenburg	610	24,610	11,779	12,831	8,222	16,388	40	127,922	1.68	32.77	2,150	975	0.45	645	215	3.52
Brunswick	580	16,707	8,333	8,374	6,022	10,685	29	96,731	7.03	26.06	6,800	2,950	0.43	618	206	11.72
Total	1,730	74,187	35,596	38,591	28,681	45,506	43	310,061	4.98	28.00	15,450	6,425	0.42	594	198	8.93

TABLE II.—ACREAGE AND PRODUCTION OF LEADING CROPS.

Counties.	COTTON.		TOBACCO.		CORN.		POTATOES.		OATS.		WHEAT.	
	Acres.	Bales.	Acres.	Pounds.	Acres.	Bushels.	Irish.	Sweet.	Acres.	Bushels.	Acres.	Bushels.
		475 *lbs.*					*Bushels.*	*Bushels.*				
Total for the State	45,040	19,595	140,791	79,988 868	1,768,127	29,119,761	2,016,766	1,901,521	503,443	5,333,181	901,177	7,826,174
Total for cotton counties	45,040	19,595	12,509	6,561,375	229,814	2,595,289	226,420	346,402	51,498	466,087	31,173	263,799
TIDE-WATER REGION.												
King and Queen	80	20	30	14,711	21,232	252,546	8,214	17,901	1,334	10,526	5,260	34,071
Prince George	1,900	700	27	20,500	16,186	183,683	4,085	10,995	5,953	54,295	3,047	33,441
Sussex	4,800	1,950	5	4,715	18,746	163,686	2,296	7,140	2,871	25,337	333	2,471
Isle of Wight	850	400	5	420	18,038	228,998	33,874	52,986	1,568	16,447	141	1,547
Nansemond	1,960	800	1	215	25,750	280,854	136,544	97,880	2,147	29,647	407	5,486
Southampton	11,500	5,200	5	775	36,012	390,968	5,744	68,315	1,417	15,061	101	858
Greensville	8,500	4,100	11	5,075	12,745	145,674	5,291	18,956	1,857	18,525	451	3,493
Total	29,590	13,170	84	46,411	148,709	1,646,409	196,048	274,173	17,147	169,838	9,740	81,367
OAK UPLANDS REGION.												
Dinwiddie	6,500	2,500	2,752	1,540,395	22,720	214,160	8,463	17,535	7,907	45,285	5,310	45,255
Mecklenburg	2,150	975	6,439	3,436,408	34,268	462,512	16,680	34,564	15,811	185,345	10,548	86,303
Brunswick	6,800	2,950	2,734	1,538,161	24,117	272,208	5,229	20,130	10,633	65,619	5,575	50,874
Total	15,450	6,425	11,925	6,514,964	81,105	948,880	30,372	72,229	34,351	296,249	21,433	182,432

PART I.

PHYSICO-GEOGRAPHICAL AND AGRICULTURAL DESCRIPTION OF THE STATE OF VIRGINIA.

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OUTLINES OF THE PHYSICO-GEOGRAPHICAL FEATURES OF THE STATE OF VIRGINIA.

Virginia, one of the middle Atlantic states, is situated between the parallels of 36° 33½′ and 39° 27′ north latitude, in the zone of southern Europe. On its southern boundary, for a distance of nearly 440 miles, it is conterminous with North Carolina and Tennessee, while on the west and northwest it touches Kentucky and West Virginia, the latter along a very irregular zigzag line, for 450 miles. The Potomac river and Chesapeake bay separate it on the north and east from Maryland, and it has an Atlantic shore-line on the east of 125 miles, extending from North Carolina to Maryland. The area of the state is estimated at 42,450 square miles. (*a*)

TOPOGRAPHY.—The land surface varies greatly in character, rising very gradually from the coast inland, and at the distance of about 100 miles, in the meridian of Richmond, reaches an elevation of about 150 feet above sea-level. This eastern region is known as tide-water Virginia, and has an extent of more than 11,000 square miles. It is a low, level, or slightly undulating country, which toward the sea is quite flat, and is penetrated with numerous bays and broad tidal rivers, bordered by marshes and swamps. Westward the surface rises by broad and nearly level terraces or benches and becomes more uneven, consisting of broad, flattish swells, separated by the river valleys. Westward of the tide-water region lies a broad, undulating, and rolling plain, which rises along its western border to an elevation of 400 or 500 feet, becoming hilly and broken. This triangular area of more than 12,000 square miles is called the *middle* or *midland* region, and extends to the foot-hills of the Blue Ridge. The rivers, which traverse this region at right angles, cut it up into a succession of northwest and southeast ridges and valleys, so that the surface is quite hilly and broken near the streams. Next in order, to the west, along the base of the Blue Ridge, lies a long, narrow belt of hilly and mountainous country, the *Piedmont*, from 20 to 30 miles in breadth and between 6,000 and 7,000 miles in area, and having an elevation of from 600 to 1,200 feet along its western edge.

The Blue Ridge rises steeply from the Piedmont and marks the eastern margin of a distinct and very different sort of country, which may be designated as the transmontane region. This region comprises three well-marked subdivisions: the *Blue Ridge chain* itself, the *valley*, and the *transmontane* region proper. The *Blue Ridge* for the greater part of its length is a straggling, irregular chain, throwing off spurs and branches each way, but otherwise of simple structure; but south of the water-gaps of the Roanoke it spreads out into a triangular plateau bounded by two chains, which form its escarpments east and west, the former, fronting the Atlantic, retaining the name of the Blue Ridge, and the western limb of the bifurcation taking the name of the Iron mountains, called in North Carolina the Smoky mountains. The elevation of the Blue Ridge varies greatly, from 1,500 feet at Harper's Ferry to more than 3,000 in places, and nearly 4,000 feet in the peaks of Otter, but reaches its culmination southward and beyond the border in the Grandfather plateau, which wants little of being 6,000 feet high.

The valley is a trough-like depression between the Blue Ridge and the Alleghanies and their continuations southward, and has a length in the state of Virginia, from the Potomac to the state of Tennessee, of more than 300 miles, its average breadth being about 20 miles, giving an area of some 6,000 square miles. The different sections of this valley are drained by as many different rivers: the northern and larger section by the Shenandoah (into the Potomac), the southern section into the Holston and the Tennessee, and the others, in succession from north to south, by the James and Roanoke (eastward to the Atlantic) and the New river and Kanawha westward into the Ohio; so that the valley is composed of a succession of inclined valleys, sloping northeast and southwest successively, and rising from an elevation of only 250 feet on the Potomac to nearly 2,000 feet at the head of the Shenandoah, and after several descents and rises of from 500 to 1,000 feet finally reaches, at the head of the Holston (and New river), an elevation of nearly 2,600 feet.

The *mountain* (or transmontane) region proper succeeds the valley on the west, and consists of a succession of narrow, sharp, regular, nearly straight mountain ranges, running northeast and southwest, separated by deep and

a The water surface is said to be 2,325 square miles, leaving the area of land surface as 40,125 square miles, as given on page 3.

narrow valleys, the crests of the chains being from 5 to 7 or 8 miles distant from one another. These valleys, like the greater one before described, are cut up into sections and drained northeast and southwest, and some of its divisions are as elevated as any part of the latter, and in some places even reach 3,000 feet.

CLIMATE.—The territory of Virginia lies mostly between the isotherms of 50° and 60°, the former crossing its southeastern peninsula in the tide-water region, and the latter marking its higher mountain plateaus. The mean annual temperature for the state is 56°; for the tide-water region, 58°; for the middle and Piedmont, 55.6°; and for the valley, 54°. The average mean temperature of the state for January is 42°, and for July 78°. As to mean annual rainfall, nearly the whole state lies in a zone of from 40 to 45 inches, the southeastern angle, about Norfolk, alone touching the zone of from 45 to 50. This precipitation is pretty equally distributed among the seasons. In the tide-water and middle regions the prevailing winds are from the southwest quadrant, and next to that the principal winds come from the opposite or northeast quadrant, the northwest quadrant occupying the third place in importance. In the Piedmont region the southwest quadrant is markedly predominant over all the others; while in the mountain region the southwest quadrant still leads, the northwest standing second in importance, and the southeast third. The notable points about the climate are, first, its range—from that of the southeastern low plain, fronting the Atlantic ocean and tempered by it, to that of the high mountain plateaus of the northwestern margin, where cold temperate conditions prevail; second, its mildness, on the whole, notwithstanding this considerable range; third, its dryness, although the rainfall is abundant, and, compared with most European countries, large. The climate is healthful and favorable to a great variety of agricultural pursuits, from cotton culture in the southeast to that of tobacco and hay in the Piedmont and the mountains.

GEOLOGY.—The different geological formations, like the topographical subdivisions, in Virginia, as in the other Atlantic states, are arranged in successive belts nearly parallel to each other and to the great Appalachian axis. The Quaternary formation is almost exactly coincident in its limits to the tide-water region, which it covers with a thin deposit of beds of shingle, earth, and gravel, which pass eastward into coarse and fine sand, and, near the coast, into clay and marl. Underneath this superficial covering, and cropping out in the lower levels, ravines, and river banks, are found Tertiary marl, shell, and clay beds. The middle and Piedmont regions to the crest of the Blue Ridge are occupied by metamorphic or Archæan rocks—granites, gneisses, and schists, which generally dip to the southeastward and at high angles.

Scattered over this Azoic terrane, generally in trough-like depressions, are frequent long linear or oval patches of red sandstones, conglomerates, and clay, and shale beds of the Mesozoic age, mainly Triassic, nearly horizontal in position. Westward of the crest of the Blue Ridge are encountered in succession the Silurian, lower and upper, in and across the valley, and the Devonian and Silurian in various alternations in the successive parallel sharp ridges and chains of mountains toward the western border and the Alleghanies. Toward the southwest the state pushes an angular area northwestward to the Cumberland mountains, and so includes about 1,000 square miles of the Carboniferous rocks—the great Appalachian coal formation, so conspicuously exposed along the cañon of the Kanawha. The outcrops of these Paleozoic formations succeed each other and repeat themselves in successive sharp folds, forming many anticlines and synclines, and, with many notable and extensive faults, making one of the most interesting and instructive sections of these rocks in the whole length of the great Appalachian uplift. Besides their coal beds, the older formations contain numerous deposits of iron ore, which throughout the mountain region crop out in beds of limonites and hematites of enormous extent. In this region are also found marble, kaolin, lead, zinc, glass sand, barites, manganese, gypsum, and salt. In the Piedmont and Blue Ridge regions are found large deposits of iron ores, copper, and marble, barite, lead, and manganese, in the middle region gold, silver, and copper, various kinds of iron ore, and bituminous coal (in the Trias near Richmond), and in the tide-water region marls and brick and fire clays, while in all the divisions of the state limestones and building materials are found, and in most of them in great variety and abundance.

AGRICULTURAL REGIONS.—The topographical and geological features above described suggest at once the agricultural subdivisions:

1. The tide-water region, subdivided into—
   a. The alluvial region proper, or seaboard region.
   b. The sandy oak and pine ridges.
2. The oak uplands region.
3. The transmontane and valley region.

THE TIDE-WATER REGION.

The tide-water region contains about 11,000 square miles of territory.

THE ALLUVIAL OR SEABOARD REGION.—This subdivision includes the peninsula between the Atlantic ocean and Chesapeake bay and the Norfolk peninsula between the Atlantic on the east and Nansemond river and Dismal swamp on the west, and to this would properly be added the ends and the other peninsulas that project between the numerous arms of the Chesapeake, as well as considerable marginal tracts along the numerous bays and bayous, amounting in all to more than 2,000 square miles of area. The description of this tract is the same as that of the corresponding adjacent region of North Carolina. It is composed largely of swamps and semi-swamps and oak and pine flats, with fine gray and ash-colored silty soils, sometimes clayey, covered with a heavy growth of white

oaks and hickories, oak, and short-leaf pines, such as the tract south of Norfolk, toward the North Carolina line, traversed by the Norfolk and Edenton railroad; sometimes composed chiefly of very fine sand and a small percentage of clay, presenting the physical characteristics of the latter, and again of very dark and peaty soils, as around the margin of the Dismal swamp in many places and in the swampy tracts near the smaller streams, with a growth of short-leaf pine, maple, ash, small black and sweet gums, and poplar. Much of this land may be described as "low, flat, and sandy; the soil thin, light, and soft, warm, and easily tilled"; in a word, as "garden soils". (*a*) The subsoil is commonly a stiff or a yellow to brown sandy clay.

SANDY OAK AND PINE RIDGES.—These generally lie level or in gentle slopes, and the soil is sandy or clayey in patches, generally poor, but susceptible of improvement, responding readily to the use of marls and other fertilizers. Occasionally these soils are very sandy and of little value. The growth is short-leaf pine, small oaks, dogwood, and underbrush, the long-leaf pine, which formerly made a component of these forests south of the James river, having nearly disappeared. The subsoil is commonly of a yellow or brown color, and is composed largely of sand, with a little clay. In some parts of this region, especially in the southwest—south of Petersburg and toward the North Carolina line—these lands repeat the features of the upland piny woods of North Carolina, having a sandy loam soil and a yellow or red clay or sandy clay subsoil. Nearly the whole of this region is underlaid by the Tertiary marls, and has a ready and abundant means for the indefinite improvement of its soils, and many of the farmers have learned the value of this resource under the intelligent teaching and example of Edmund Ruffin. The character and value of these marls may be seen in the analysis given for those of North Carolina, which they exactly resemble. (See page 22 of that report.)

THE OAK UPLANDS REGION.

The soils of this region, derived from the underlying metamorphic rocks, of course vary in composition and character according to the changing character of their origin from one terrane to another, the hornblendic granites and gneisses, the traps, and the epidotic and chloritic beds giving rise to rich mulatto and red-clay soils; the quartzose light-colored gneisses and schist and the quartzites and clay slates form poor or moderately productive sandy and gravelly loams, with yellow or brown clay or sandy clay subsoils. The growth of timber of course varies with the quality of the soil, and furnishes the observing farmer a sure criterion by which to grade the value of land and to determine its adaptations to different crops. The red lands have characteristically a heavy growth of oaks, hickory, poplar (*Liriodendron*), and walnut, and are specially adapted to wheat. The gray sandy and gravelly loams have a smaller and more scattered growth of oaks, with short-leaf pine (*P. mitis*), dogwood, sourwood, sassafras, and various underbrush, and, toward the Piedmont region, of chestnut, chestnut oak, and Jersey pine, but are poor or of moderate fertility, and are specially adapted to the finer varieties of tobacco. The red sandstone (Triassic) belts of the middle country belong to the oak uplands; their soils are commonly red or brown loams, which are moderately and often very productive and easy of tillage. These soils, as in North Carolina, belong for the most part to the best class of tobacco lands. The rivers, creeks, and smaller streams of this region are often bordered by extensive alluvial tracts or "bottoms", which are commonly the most productive and durable lands, and are the staple *corn lands* of the region. The soils are usually clays or clay loams, and were originally covered with heavy white oak, hickory, poplar, and walnut forests. These lands comprise in many counties from one-twentieth to one-tenth of the total area and a much larger proportion of the tilled land, as they are always the first to be cleared on the farm, and are rarely "turned out".

THE TRANSMONTANE AND VALLEY REGION.

This great valley being a limestone region, the soils generally are what are called limestone soils. (*a*) "The prevailing soil is a stiff, clayey loam, durable and fertile, and well adapted to the growth of grass and grain." "In the slaty belt is a lighter and warmer soil. There are also belts of sandy and gravelly soil. Much the larger part of the valley has naturally a good soil." "The streams are very winding, and there is a considerable area of bottom lands."

Beyond the valley, in the Alleghany ridges, the soils are very various, those of the sandstone ridges and slate valleys being poor and thin, while those of the limestone and of some of the shales are very rich. On the streams everywhere are alluvial lands.

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a Hotchkiss' *Summary*.

REMARKS ON COTTON PRODUCTION IN THE STATE.

Among the cotton states Virginia ranks fifth in population, twelfth in cotton production (19,595 bales), and eighth (with North Carolina) in average product per acre (0.44 of a bale). The product in 1860 was 12,727 bales; in 1870, 183 bales.

TABLE III.—SHOWING POPULATION AND COTTON-PRODUCTION IN EACH AGRICULTURAL REGION OF THE STATE.

	POPULATION.			COTTON PRODUCTION.									
							Average per acre.			Total in tons.			
	Total.	White.	Colored.	Acres.	Percentage of tilled land devoted to cotton.	Bales.	Fraction of a bale.	Seed-cotton.	Lint.	Lint.	Seed.	Percentage of state's total production.	Average cotton acreage per square mile.
								Lbs.	*Lbs.*				
Total for the state	1,512,565	880,858	631,707	45,040	0.61	19,595	0.44	621	207	4,654	13,962	100	1.15
Tide-water region	83,512	34,982	48,530	29,590	6.38	13,170	0.45	.633	211	3,128	9,384	67	11.00
Oak uplands region	74,187	28,681	45,506	15,450	4.98	6,425	0.42	594	198	1,526	4,578	33	8.93

TABLE IV.—SHOWING "BANNER COUNTIES" AS REGARDS TOTAL PRODUCTION AND PRODUCT PER ACRE IN EACH AGRICULTURAL REGION.

Regions according to product per acre.	Average product per acre of the region in bales.	Counties in each region having highest total production.	Rank in product per acre in the state.	Cotton acreage.	Total product in bales.	Product per acre in bales.	Counties in each region having highest product per acre.	Rank in total production in the state.	Cotton acreage.	Total production in bales.	Product per acre in bales.	Rank in product per acre in the state.
Tide-water region	0.45	Southampton	4	11,500	5,200	0.45	Greensville	2	8,500	4,100	0.48	1
Oak uplands region	0.42	Brunswick	5	6,800	2,950	0.43	Mecklenburg	6	2,150	975	0.45	3

NOTE.—In making estimates for this table all counties are excluded whose total production is less than 100 bales.

It will be noted that the alluvial or tide-water region does not take precedence in cotton production, as the corresponding adjacent (long-leaf pine) region in North Carolina does, and as would be expected from their relative situation. The three oak uplands counties, in fact, lead by a little, because of the substitution of the peanut as a money crop in the former. In some of the counties the change has taken place in the last three or four years, while this crop has not been adopted to any considerable extent over the border. It is also observable that, while the seaboard section of North Carolina has a sufficiently large and rapidly increasing cotton production to take rank as one of the cotton regions of North Carolina, in Virginia these counties produce no cotton at all, the small cotton product of some of them a few years ago being displaced by garden and orchard products (trucking), in which this section about Norfolk has altogether exceptional facilities, not only in soil and climate, but in nearness to the great markets and in the amplest and cheapest and most rapid transportation.

There are only ten counties that produce cotton, and all lie in the southeastern angle of the state between the James river and the North Carolina line, except one, King and Queen, which makes less than 100 bales. Of the nine cotton counties proper five are situated along the North Carolina border west of the Dismal swamp, and the four others form a second tier north of the former; so that the cotton area of Virginia merely forms a slight extension northward of the cotton area of that state, and all these cotton counties, except three, belong to the tide-water or alluvial region.

In comparing the cotton product of 1880 with that of 1860 and 1870 the culture of cotton appears to have been annihilated by the war and to have made no movement toward revival in 1870. Its growth within the past decade to more than 50 per cent. above the crop of 1860, and the removal of the boundary of the cotton-growing belt into the oak uplands and its encroachment on the territory of tobacco, are due to the same cause as in North Carolina, viz, the use of commercial fertilizers, which have rendered its culture profitable in places where otherwise it would be quite impracticable. But the probability seems to be that it has about reached the limit of its expansion in the state, since, as above stated, in the tide-water region it is already retreating before the culture of the peanut, and in the oak uplands, as in the adjacent section of North Carolina, it has scarcely held its ground in the past few years against the improved and far more profitable form of tobacco culture recently introduced, that of the coal-cured, bright tobacco.

PART II.

AGRICULTURAL DESCRIPTIONS

OF THE

COTTON-GROWING COUNTIES OF THE STATE.

AGRICULTURAL DESCRIPTIONS

OF THE

COTTON-GROWING COUNTIES OF VIRGINIA.

The ten counties that produce cotton are grouped according to their agricultural regions, and all, except King and Queen, lie in the southeastern angle of the state.

Reports were received from only four counties. To the description of these abstracts of the reports are appended, giving the natural features, production, etc. The parts of the reports relating to agricultural and commercial practice will be found summarized in Part III.

TIDE-WATER OR ALLUVIAL REGION.

The cotton-growing counties belonging to this region are Nansemond, Isle of Wight, Southampton, Sussex, Greensville, Prince George, and King and Queen.

NANSEMOND.

Population: 15,903.—White, 7,728; colored, 8,175.

Area: 400 square miles.—Woodland, 114,452 acres.

Tilled lands: 57,651 acres.—Area planted in cotton, 1,960 acres; in corn, 25,750 acres; in wheat, 407 acres; in oats, 2,147 acres.

Cotton production: 800 bales; average cotton product per acre, 0.41 bale, 582 pounds seed-cotton, or 194 pounds cotton lint.

Nansemond county lies east and west between the Dismal swamp (a large section of which it includes) and the Blackwater river, and reaches north and south from the James river to the North Carolina line. Its highest portions are from 50 to 60 feet above tide. The county includes large bodies of swamp and semi-swamp lands, as in the Dismal swamp and around its margins, as well as along the Blackwater and other streams. When drained, these lands are very productive, but they are not adapted to cotton. The timber is short-leaf pine, oaks, and underbrush. The long-leaf pine has been nearly exterminated by the saw-mills.

The soil of the level piny woods is of the normal character of that of the region already described. Cotton culture has greatly increased during the last decade, especially within the last year or two, and has extended over the whole county, although the bulk of the crop is made in the southern half. Of its area, 22.5 per cent. is under cultivation, 3.4 per cent. of which is devoted to cotton.

ABSTRACT OF THE REPORT OF JOHN A. CUTCHIN, OF CARRSVILLE.

The principal soil is a *dark sandy*, with clay subsoil, and extends throughout this township. The natural timber is pine and red and white oak, with a thick undergrowth of smaller kinds of timber. The chief crops are corn, cotton, peanuts, sweet and Irish potatoe and truck. Cotton occupies about one-tenth of the land cultivated. The stalk attains a height of from 2½ to 3 feet, and is most productive at the latter height. The cotton-plant inclines to run to weed in wet seasons, about the time it is blooming, and topping is resorted to in July and August to restrain it. Fresh land produces 1,000 pounds of seed-cotton per acre, 1,425 pounds making a 475-pound bale of lint; clean staple rates low middling. Crab-grass is the most troublesome.

Cotton shipments are made by rail to Norfolk.

ISLE OF WIGHT.

Population: 10,572.—White, 6,010; colored, 4,562.

Area: 290 square miles.—Woodland, 115,799 acres.

Tilled lands: 50,756 acres.—Area planted in cotton, 850 acres; in corn, 18,038 acres; in wheat, 141 acres; in oats, 1,568 acres.

Cotton production: 400 bales; average cotton-product per acre, 0.47 bale, 672 pounds seed-cotton, or 224 pounds cotton lint.

Isle of Wight county lies north of Nansemond, and between the James and the Blackwater. The physical and agricultural features are the same as those of the latter; but being situated farther north, it is less adapted to cotton and better adapted to peanuts. There is little left of the long-leaf pine here also, although it was formerly abundant in the southern and southwestern sections and supported a thriving turpentine industry half a century ago. Twenty-seven and three-tenths per cent. of the county area is under cultivation, and of this 1.7 per cent. is devoted to cotton.

Mr. N. P. Young, of Isle of Wight Court-House, reports as follows:

From the best information I can obtain cotton is cultivated to a very limited extent. I do not think an average of 10 bales a year is made in the county, its cultivation having been almost entirely abandoned for that of peanuts.

Cotton is shipped to Norfolk by railroad.

SOUTHAMPTON.

Population: 18,012.—White, 7,447; colored, 10,565.
Area: 610 square miles.—Woodland, 149,631 acres.
Tilled lands: 107,269 acres.—Area planted in cotton, 11,500 acres; in corn, 36,012 acres; in wheat, 101 acres; in oats, 1,417 acres.
Cotton production: 5,200 bales; average cotton product per acre, 0.45 bale, 645 pounds seed-cotton, or 215 pounds cotton lint.

Southampton county is situated on the North Carolina border between the Blackwater and the Meherrin rivers, and is traversed through its middle portion by the Nottoway. It rises in its western and northern sections to a height of over 100 feet above tide. The surface is generally level, or but little rolling, and occasionally it is hilly in the western section near the rivers. The timber consists chiefly of short-leaf pine and oaks, intermixed with dogwood, maple, hickory, poplar, sassafras, gums, and various underbrush. Of the county area, 27.5 per cent. is under cultivation, and of this 10.7 per cent. is in cotton.

The cotton crop is mostly made south of the Nottoway, the chief crop of the northern section being peanuts, although cotton is raised in all sections.

ABSTRACT OF THE REPORT OF DR. W. H. DAUGHTRY, OF NEWSOM'S.

The chief soil is mostly of a *light gray sandy character*, with yellow or red subsoil, which occupies about one-half of the lands in this region, and is timbered with pine, oak, hickory, dogwood, maple, and poplar. The light, fine sandy surface soil is from 4 to 6 inches thick, and is easily tilled. The chief crops produced here are corn, cotton, peanuts, and potatoes, but the soil is apparently best adapted to corn. About one-sixth of the arable land is planted in cotton. The plant attains the height of from 2 to 4 feet, and is most productive when 3 feet in height, but it inclines to run to weed in wet and warm weather. Very little of this land lies turned out. The product is from 400 to 600 pounds of seed-cotton per acre, and 1,425 pounds make a 475-pound bale. After five years' cultivation the product is about 400 pounds per acre. Crab- and wire-grass and hog-weed are most troublesome. Very little land lies turned out, and it produces well when again taken in. Very little damage is done by washing or gullies on the slopes.

A second quality of land, designated as *white-oak land*, comprises about one-fourth of the lands of the region, and has a timber growth of oak, gum, pine, etc. The soil is a clay, 4 inches in thickness, over a blue-clay subsoil. One-fourth is planted in cotton, though the land is best adapted to clover.

Shipments to Norfolk by rail or steamer; freight, $1 per bale.

The report of Mr. J. D. Prettow, of Franklin, agrees generally with the preceding.

Four-fifths of the lands are of the description of No. 1, and have a red sandy clay subsoil. One-tenth is planted in cotton, which grows from 3 to 5 feet high. About one-sixth lies turned out. Peanuts are the most profitable crop.

SUSSEX.

Population: 10,062.—White, 3,361; colored, 6,701.
Area: 400 square miles.—Woodland, 107,617 acres.
Tilled lands: 54,989 acres.—Area planted in cotton, 4,800 acres; in corn, 18,746 acres; in wheat, 333 acres; in oats, 2,871 acres.
Cotton production: 1,950 bales; average cotton product per acre, 0.41 bale, 579 pounds seed-cotton, or 193 pounds cotton lint.

Sussex county lies north of and adjacent to Southampton, and between the upper affluents of the Blackwater and the Nottoway, and its territory is nearly all included between the Petersburg and the Norfolk and Petersburg railroad. The long-leaf pine formerly extended into the southern and eastern sections, but has almost entirely disappeared. The soil and timber are in the southern part like those of Southampton, but toward the west and north the surface becomes more uneven, and approximates the character of the oak uplands. But little cotton is made in this section, its culture being confined to the southern half, peanuts being the staple crop northward. Of the county area, 21.5 per cent. is under cultivation, and of this 8.7 per cent. is devoted to cotton.

ABSTRACT OF THE REPORT OF J. D. THORNTON, OF SUSSEX COURT-HOUSE.

Our county, except the extreme western portion, which is hilly and not adapted to cotton, is mostly level.

The *light-gray soil*, which occupies three-fourths of the land, extends toward the south and east fully 50 miles, but toward the north and west it assumes a different character, and is a heavy red clay. Pine is the principal timber, but red oak, hickory, and dogwood prevail, as also white oak in the flats. The surface soil is a fine gray loam of close texture, with but little sand; sometimes the color is a rich chocolate to the depth of 6 inches, when it changes into that of the subsoil, which is heavier than the surface soil. On the best lands the subsoil is of a deep red, which in two or three years becomes light and friable, mingling easily and advantageously with the upper soil.

This soil is easy to till in wet or dry seasons, and is early, warm, and naturally well drained. Peanuts have within three or four years become the principal money crop, having superseded cotton; the other main crops are corn, oats, and wheat. The cotton-plant usually attains a height of from 2½ to 3 feet, and is most productive at that height. It inclines to run to weed in very rich land, especially when there is much moisture in the soil; topping is resorted to by some to restrain this tendency. In fresh land the product is about 500 pounds of seed-cotton per acre, and 1,425 pounds are required to make a 475-pound bale of lint. If not manured, the crop becomes annually less. Crab-grass is the chief pest; also some wire-grass. But little land now lies turned out.

Cotton shipments are made in November and December by rail to Petersburg. The rate of freight is from 35 to 50 cents, according to weight.

GREENSVILLE.

Population: 8,407.—White, 2,757; colored, 5,650,
Area: 330 square miles.—Woodland, 81,105 acres.
Tilled lands: 42,556 acres.—Area planted in cotton, 8,500 acres; in corn, 12,745 acres; in wheat, 451 acres; in oats, 1,857 acres.
Cotton production: 4,100 bales; average cotton product per acre, 0.48 bale, 687 pounds seed cotton, or 229 pounds cotton lint.

Greensville county lies on the southern border, and belongs mainly to the alluvial region, its western end rising into that of the oak uplands. Its general elevation is above 150 feet, the body of the county lying west of the Petersburg railroad and being above that level. The abstract below gives a sufficiently full account of its agricultural features and products. Of the county area, 20.1 per cent. is under cultivation. Cotton comprises 20 per cent. of the tilled lands.

ABSTRACT OF THE REPORT OF JULIUS F. BINGHAM, OF POPLAR MOUNT.

The kinds of soil are: First, the gray sandy; second, the sandy loam; and last, the red clay.

The chief soil is the *gray sandy or light lands*, which occupy one-half of the lands in this region and are timbered with oak, pine, hickory, ash, poplar (tulip tree), black walnut, and maple. The average thickness of the surface soil is 10 inches; the subsoil is heavier, and is generally a mixture of yellow sand and clay. The soil is easy to till, early, warm, and well drained. The chief crops are cotton, peanuts, corn, oats, and potatoes, but the soil is best adapted to cotton and peanuts, and cotton occupies about one-third of the cultivated portion. It is most productive when from 2½ to 3 feet high, and is inclined to run to weed in wet seasons. Shallow cultivation and topping are resorted to as preventives. Fresh land produces 600 pounds of seed-cotton per acre, 1,425 pounds making a 475-pound bale of lint; clean staple rates as middling. After four years' cultivation without manure the production falls off rapidly. About one-fourth of the land now lies turned out, and it improves by rest. Where the land is hilly it is apt to wash, but this is easily obviated by horizontal ditches; the valleys are generally improved by washings from the hills.

No. 2. *Sandy loam* comprises one-fourth of the lands, occurring in large bodies on Three Creeks and on both sides of the Meherrin river. The timber growth has more ash and maple than in No. 1. The color of the soil is dark gray to a depth of from 8 to 12 inches; the subsoil is a yellow or red clay, best adapted to cotton and corn, but one-half is planted in cotton. Crab-grass is troublesome.

No. 3. The *red-clay* soils comprise one-fourth of the lands, and lie in the western end of county. The timber is oak, hickory, ash, and maple. The color of soil is deep mahogany, red and chocolate. The soil is 8 inches deep, and is best adapted to wheat, clover, and grass; very little is planted in cotton. About one-fourth of this land lies turned out, which produces well after a few years' rest, but washes and gullies badly. The valleys are not injured by the washings, but are often improved. These washings are checked by hillside ditching and horizontalizing.

Cotton shipments are to Norfolk and Petersburg by rail; freight, 90 cents to $1 per bale.

Mr. W. F. Avent, of Hopeville, also makes report, agreeing in the main with the above, but differing in some of his estimates.

The proportion of *light sandy land* is four-fifths; the depth of soil, 6 inches, and the proportion of cotton planted one-half. When the soil is worn out it is occupied by old field pines. The lands are generally very poor, and one-half now lies turned out. The chief crops of the western section are tobacco and wheat.

PRINCE GEORGE.

Population: 10,054.—White, 3,255; colored, 6,799.
Area: 300 square miles.—Woodland, 60,315 acres.
Tilled lands: 59,243 acres.—Area planted in cotton, 1,900 acres; in corn, 16,186 acres; in wheat, 3,047 acres; in oats, 5,953 acres.
Cotton production: 700 bales; average cotton product per acre, 0.37 bale, 525 pounds seed-cotton, or 175 pounds pounds cotton lint.

Prince George county is situated on the western edge of the tide-water plain between the Petersburg railroad and the James river, and north of the county of Sussex, before described. Its elevation is below 100 feet for the most part, but topographically it is generally level or but little rolling, and somewhat hilly near the streams. Its forests present the usual mixture of oaks and short-leaf pine, etc., and its soils are generally the common light-gray sandy and gravelly loams of the region. It lies just beyond the border of the long-leaf pine region, its eastern angle near the James river having a few scattered specimens only. Of the county area, 30.9 per cent. is under cultivation, and 3.2 per cent. of its tilled lands are devoted to cotton. This may be regarded as the northern extremity of the cotton zone of the south. The small crop of cotton is shipped to Norfolk by steamer or by rail.

KING AND QUEEN.

Population: 10,502.—White, 4,424; colored, 6,078.
Area: 360 square miles.—Woodland, 72,804 acres.
Tilled lands: 91,086 acres.—Area planted in cotton, 80 acres; in corn, 21,232 acres; in wheat, 5,260 acres; in oats, 1,334 acres.

Cotton production: 20 bales; average cotton product per acre, 0.25 bale, 357 pounds seed-cotton, or 119 pounds cotton lint.

King and Queen county is quite exceptionally situated for a cotton county, being not only north of the James river, but north of York river (Pamunkey), and some 30 miles northeast of Richmond. It lies near the western border of the tide-water region, in the section of the level sandy ridge soils. As there is no report from this county, the peculiar local circumstances and climatic conditions which render the culture of cotton practicable so far out of its range cannot be given. The percentage of area under cultivation is 39.5, and of this 0.1 per cent. is devoted to cotton.

OAK UPLANDS REGION.

Cotton is grown in three counties of the region: Brunswick, Mecklenburg, and Dinwiddie.

BRUNSWICK.

Population: 16,707.—White, 6,022; colored, 10,685.

Area: 580 square miles.—Woodland, 167,621 acres.

Tilled lands: 96,731 acres.—Area planted in cotton, 6,800 acres; in corn, 24,117 acres; in wheat, 5,575 acres; in oats, 10,633 acres.

Cotton production: 2,950 bales; average cotton product per acre, 0.43 bale, 618 pounds seed-cotton, or 206 pounds cotton lint.

Brunswick county lies adjacent to the oak uplands cotton section of North Carolina, near the eastern edge of the region, and has, therefore, only a moderate elevation of between 200 and 300 feet. It reaches northward to the main branch of the Nottoway. Its physical and agricultural characteristics are normal for this section, and the surface moderately rolling or hilly near the streams. The forests are of oak, short-leaf pine (*P. mitis*), hickory, dogwood, etc. The soils generally are a gray sandy loam on the ridges, reddish and more clayey on the slopes, with strips of red clay and mulatto soils wherever the rocks are hornblendic. Of the area, 26 per cent. is in cultivation, and of this 7 per cent. is devoted to cotton. The cotton product is made, of course, mainly in the southern part of the county. No report has been received, so that further details cannot be given.

MECKLENBURG.

Population: 24,610.—White, 8,222; colored, 16,388.

Area: 610 square miles.—Woodland, 170,685 acres.

Tilled lands: 127,922 acres.—Area planted in cotton, 2,150 acres; in corn, 34,268 acres; in wheat, 10,548 acres; in oats, 15,811 acres.

Cotton production: 975 bales; average cotton product per acre, 0.45 bale, 645 pounds seed-cotton, or 215 pounds cotton lint.

Mecklenburg county lies west of Brunswick and on the North Carolina border, and is on the extreme northwestern limit of the cotton belt (the larger part outside of it). It is a little more elevated (from 300 to 500 feet) and more hilly than Brunswick. Roanoke river flows through the southern part, keeping near the border, and its tributaries drain nearly the whole county. This river is navigable for flat-boats, by means of which the tobacco crop has long been carried to market. It has now also the advantage of transportation by rail. The principal town is Clarksville, at the forks of the Roanoke, the confluence of the Staunton and Dan rivers. The forests and soils are like those of Brunswick county, with an increase in the proportion of red clays. The main agricultural interest centers in tobacco, but it is a good grain country also. Of its area, 32.8 per cent. is in cultivation, and of this 1.7 per cent. is devoted to cotton.

DINWIDDIE.

Population: 32,870.—White, 14,437; colored, 18,433.

Area: 540 square miles.—Woodland, 133,561 acres.

Tilled lands: 85,408 acres.—Area planted in cotton, 6,500 acres; in corn, 22,720 acres; in wheat, 5,310 acres; in oats, 7,907 acres.

Cotton production: 2,500 bales; average cotton product per acre, 0.38 bale, 549 pounds seed-cotton, or 183 pounds cotton lint.

Dinwiddie county lies north of Brunswick, and extends north to the Appomattox river, but it is drained mostly by the various branches of the Nottoway. Its situation is like that of Brunswick, on the eastern border of the oak uplands region. It has about the same elevation, geographical features, agricultural characteristics, and industries, dividing its interest between cotton and tobacco. Petersburg is its chief town. Of its area, 24.7 per cent. is under cultivation, and 7.7 per cent. of this is devoted to cotton. Its means of transportation are ample, and are by river and two railroads to Richmond and Norfolk.

PART III.

CULTURAL AND ECONOMIC DETAILS OF COTTON PRODUCTION.

REFERENCE TABLE

OF

REPORTS RECEIVED FROM THE COUNTIES OF VIRGINIA.

TIDE-WATER OR ALLUVIAL REGION.

Nansemond.—JOHN A. CUTCHIN, Carrsville, Isle of Wight county (farm and residence in Nansemond), describes the lands of his township.

Isle of Wight.—N. P. YOUNG, Isle of Wight Court-House.

Southampton.—J. D. PRETTOW, Franklin, October 12, 1880, describes lands of the county. Dr. W. H. DAUGHTRY, August 19, 1880, of Newsom's, describes lands of the county.

Sussex.—J. D. THORNTON, Sussex Court-House, February 11, 1880, describes lands of the county and region.

Greensville.—JULIUS F. BINGHAM, of Poplar Mount, June 13, 1880, describes lands of the county. W. F. AVENT, of Hopeville, March 29, 1880, describes lands of the county

SUMMARY OF ANSWERS TO SCHEDULE QUESTIONS.

TILLAGE, IMPROVEMENT, ETC.

1. What is the usual depth of tillage? What draft is employed in breaking up? Is subsoiling, fall plowing, fallowing, or rotation of crops practiced?

The depth of tillage is usually 4 inches, and one horse or mule is employed. Subsoiling is not done. Fall plowing is practiced in Nansemond, and but very little in other counties; results are beneficial. Fallowing is practiced to some extent, and the lands are tilled while lying fallow. *Sussex:* Generally sown in wheat or clover, the lands are rapidly recuperated. *Southampton:* Lands are only turned out. Rotation of crops is practiced in Greensville and Nansemond with corn, sweet potatoes, oats, and wheat, and maintains the average fertility of the soil. It is not practiced in Sussex, but is in Southampton with corn, sweet potatoes, oats, and peanuts.

2. What fertilizers, or other direct means of improving the soil, are used by you, or in your region? Is green-manuring practiced? With what results?

Greensville: Barn-yard manure, compost of manure of animals, with rich mold and superphosphates, with good results. Green manuring is practiced with cow-pease with fine results. *Nansemond:* Peruvian, lime, phosphates, etc. Green manuring to some extent with cow-pease, which lightens and enriches the soil. *Sussex:* Compost of ashes, cottonseed, wood-mold; also commercial fertilizers; the results are good. Green manuring with cow-pease and rye; the results are most satisfactory. *Southampton:* Barn-yard manure, guano, bone, kainit, etc., with good results. Occasionally with cow-pease, and with very good success.

3. How is cottonseed disposed of? If sold, on what terms, or at what price? Is the cake used with you for feed? Is it used for manure?

Greensville: Some is fed to cows, but it is usually put in compost heaps; when sold, the price is 10 cents per bushel. *Nansemond:* Mixed with stable manure and wood-mold and spread in the drill; price, when sold, 12½ cents per bushel. *Sussex* and *Southampton:* Put in compost heaps; when sold, the price is from 8 to 12 cents per bushel.

Cottonseed-cake is not used for feed, but is used for manure in Greensville, mixed with vegetable mold and animal matter.

PLANTING AND CULTIVATION OF COTTON.

4. What preparation is usually given to cotton land before bedding up? Do you plant in ridges, and how far apart? What variety is preferred, and how much seed is used per acre?

Greensville: We turn it over in the spring plowing, and then bed it up and plant. *Nansemond:* Flushing when it can be done; spring plowing when we are unable to plow in the fall. *Sussex* and *Southampton:* Spring plowing, then marking the rows and bed up. Cotton is usually planted in ridges, 3 feet apart on ordinary land and 3½ feet on rich lands.

Varieties of cotton are the Johnson, Davidson, Boyd, Peeler, Williams, and Little Rock. Three bushels of seed are used per acre.

5. What implements do you use in planting? Are cottonseed planters used, and what opinion is held of their efficacy or convenience?

Planters are used in all the counties except Sussex, where the rows are opened up with a plow, the seed is dropped by hand, and covered with a log drawn across two rows at once.

The cottonseed planters are well thought of where used.

6. What is the usual planting time? How long before the seed comes up, and at what stage of growth do you thin out?

The usual planting time is from April 25 to May in Sussex and Southampton, and from May 1 to 10 in the other counties. The seed comes up in from 5 to 10 days in Greensville; from 7 to 10 days in other counties. The plants are thinned out to distances of from 8 to 10 inches when the crop is entirely up, when from 5 to 6 inches high, or when the third leaf appears on the plants.

7. What after-cultivation do you give, and with what implements? Is your cotton liable to suffer from "sore-shin"?

Greensville: Plow with sweep about three times, using the hoe when necessary.

Nansemond: Keep it well grassed, and give it three plowings, first scraping and then using a cotton plow to work up the soil.

Sussex and *Southampton:* Work with the plow and take out the grass and weeds with a hand hoe.

"Sore-shin" does not appear in any county, except Nansemond, and there only when injured by the plow or hoe.

8. What is the height usually attained by your cotton before blooming? When do you usually see the first blooms? When do the bolls first open, and when do you begin your first picking?

Blooms appear when cotton is from 12 to 18 inches high in Greensville and Nansemond, and from 18 to 24 inches in Sussex and Southampton, and usually about the 1st of July. Bolls open about the last of August in Sussex and Southampton, but early in September in other counties. Picking begins October 1 in Sussex, and from September 15 to the 30th in other counties.

9. How many pickings do you usually make, and when? Do you ordinarily pick all your cotton? At what time does picking usually close? When do you expect the first black frost? Do you pen your seed-cotton in the field or gin as picking progresses?

Two pickings are made in Nansemond and Sussex, October 1 and the last of November in the former, and October and November and December and January in the latter county. Three pickings are made in Greensville and Southampton, September 20, October 20, and December 15. All the cotton is usually picked and the season closes from the 15th to the 25th of December in three counties, and in January in Sussex.

The first black frost is expected October 1 in Nansemond, from October 10 to 20 in Sussex and Southampton, and November 1 in Greensville.

Cotton is ginned as picking progresses in all counties.

GINNING, BALING, AND SHIPPING.

10. What gin do you use? How many saws? What motive power? If draft animals, which mechanical "power" arrangement do you prefer? How much clean lint do you make in a day's run of ten hours? How much seed-cotton is required for a 475-pound bale of lint?

Brown's gin, of 60 saws, in Nansemond and Southampton; with water-power turbine wheel, or with 4½ horse-power steam-engine, it makes 2,500 pounds of lint per day.

Taylor's gin in Sussex, from 40 to 60 saws; with 4 mules, it makes about 700 pounds of lint.

In Greensville various gins, of from 40 to 60 saws, make each about 2,000 pounds of lint.

For a bale of lint is required 1,425 pounds of seed-cotton in Greensville and Nansemond, from 1,300 to 1,425 in Sussex, and 1,360 in Southampton.

11. What press do you use for baling? What press is generally used in your region? What is its capacity when run by men and horses or mules?

Greensville: Ball's; when run by 5 men the capacity is 7 or 8 bales per day. *Nansemond:* Large wooden screw. *Sussex:* Virginia. *Southampton:* Cockade and hand-presses.

12. Do you use rope or iron ties for baling? If the latter, what fastening do you prefer? What kind of bagging is used? What weight do you aim to give your bales? Have transportation companies imposed any conditions in this respect?

Iron ties are used exclusively, together with both the buckle and the arrow fastening. Double anchor, coarse hemp, gunny, Dundee, and Ludlow bagging is used. The weight of bales is 400 pounds in Sussex; 450 pounds in other counties. No conditions have been imposed by transportation companies.

DISEASES, INSECT ENEMIES, ETC.

13. By what accidents of weather, diseases, or insect pests is your cotton crop most liable to be injured—caterpillar, boll-worm, shedding, rot of bolls, rust, or blight? At what dates do these several pests or diseases usually make their appearance, and to what cause is the trouble attributed by your farmers?

Greensville: By shedding, by rust, and by blight. They appear from July 15 to August 1, and are caused by wet weather. *Nansemond:* By rust and by blight. They usually appear in the latter part of August, and are attributed to rainy weather. *Sussex:* By frosts, by blight, and by shedding. We generally look for frost by October 10, shedding in August, and by rust in September. *Southampton:* By caterpillar and by boll-worm in August, rust, blight, and shedding in last of July or August; rot of bolls in August or September. Wet weather causes shedding, rot of bolls, rust, and blight.

14. What efforts have been made to obviate the trouble? Is Paris green used as a remedy? Is rust or blight prevalent chiefly on heavy or ill-drained soils? Do they prevail in wet or dry, cool or hot seasons?

On the first appearance of rust pull up the affected stalks; this often stops it. *Sussex:* Lime applied to cotton land in the fall or winter is thought to be a preventative for rust, with uncertain results. *Southampton:* Deep plowing and free manuring have been used to prevent rust and blight on ill-drained and thin lands; results were favorable. Paris green is not used in any county. Rust or blight prevails in Greensville and Southampton counties on ill-drained soils in wet, hot seasons, and are most common in sandy soils. In Nansemond county they prevail on heavy and ill-drained soils in cool, wet seasons. In Sussex county they prevail in dry, hot seasons.

LABOR AND SYSTEM OF FARMING.

15. What is the average size of farms or plantations in your region? Is the prevalent practice "mixed farming" or "planting"? Are supplies raised at home or imported; and, if the latter, where from? Is the tendency toward the raising of home supplies increasing or decreasing?

In Nansemond county, 200 acres; in other counties, 400 acres. "Mixed farming" alone is practiced. Supplies in Sussex county are mostly imported from Baltimore and Cincinnati. In other counties supplies are mostly raised at home. The tendency toward the latter is increasing, except in Nansemond, where it is unvarying.

16. Who are your laborers chiefly, whites (of what nationality), negroes, or Chinese? How are their wages paid—by the year, month, or day? At what rates? When payable?

Greensville: More than 50 per cent. negroes; they are paid from $50 to $100 per year, payable December 25. *Nansemond:* Generally negroes; they are paid from $75 to $100 per year, from $6 to $10 per month, and from 25 to 50 cents per day, payable as they want it. *Sussex:* Negroes; they are paid $80 per year, $8 per month, or 40 cents per day, with board. *Southampton:* Negroes; they are paid $6 to $10 per month, payable when they require it.

17. Are cotton farms worked on shares? On what terms? Are any supplies furnished by the owners? Does your system give satisfaction? How does it affect the soil and quality of the staple?

Sometimes worked on shares. For rent of land the tenant gives one-third of the crop; for rent and teams one-half of the crop. Supplies are seldom furnished by the owners. Perfect satisfaction is given. The quality of the staple is not affected, but the soil usually deteriorates.

18. Which system (wage or share) is the better for the laborer, and why? What is the condition of the laborer? What proportion of negro laborers own land or the houses in which they live?

Greensville and *Sussex:* Shares, because he takes greater interest in the crop, and can raise pork at the same time; the negro invariably spends his wages as fast as received. *Nansemond* and *Southampton:* Wages, because he works more steadily and can get money as he needs it; laborers are not able to sustain themselves a whole year under the share system.

The condition of the laborer is rather poor in Southampton, comfortable in Greensville, contented in Sussex, and very good in Nansemond.

About one-half of the negro laborers own land in Nansemond, 1 per cent. in Sussex and Southampton, and not one in fifty in Greensville.

19. What is the market value and rent of your lands? How many acres or 450-pound bales per "hand" is your customary estimate?

Lands are valued at from $3 to $5 per acre in Greensville and Sussex, from $3 to $10 in Southampton, and from $6 to $10 per acre in Nansemond county. Rents are from $2 to $4 per acre or one-fourth of the crop. The customary estimate per "hand" is 2 bales in Sussex and 3 bales in Greensville, but in these as well as other counties other crops are raised by the same hands.

20. To what extent does the system of credits or advances upon the growing cotton crop prevail in your region?

Greensville: To an alarming extent. *Nansemond:* Sufficient to supply moderate demands of the tenant or laborer. *Sussex:* Fully nineteen-twentieths of our laborers and farmers obtain their supplies in this manner. *Southampton:* To so great extent as frequently to absorb the entire crop.

21. At what stage of its production is the cotton crop usually covered by insurance? Is such practice general? What are the merchants' commissions and charges for storing, handling, shipping, insurance, etc., to which your crop is subject? What is the total amount of these charges against the farmer per pound or bale? What is your estimate of the cost of production in your region, exclusive of such charges and with fair soil and management?

Cotton is only insured when stored or ready for market. Charges are 2½ per cent. commission on gross sales and 25 cents per bale for storage and insurance, or a total of about $1 30 per bale in Greensville, $2 50 in Sussex, and $2 in Southampton. The estimate of cost of production is 8 cents per pound in Sussex and Southampton, and nearly 10 cents in Greensville.

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REPORT

ON THE

PHYSICAL AND AGRICULTURAL FEATURES

OF THE

STATE OF CALIFORNIA,

WITH A DISCUSSION OF

THE PRESENT AND FUTURE OF COTTON PRODUCTION IN THE STATE;

ALSO,

REMARKS ON COTTON CULTURE IN NEW MEXICO, UTAH, ARIZONA, AND MEXICO.

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INTRODUCTORY LETTER.

The state of California has until recently been considered simply as a great mining country by the people of the states east of the Rocky mountains, and comparatively little thought or attention has been given to any other capabilities it might possess. The state has, however, risen rapidly in agricultural importance, and her mining enterprises are being overshadowed by the immense farming industries, to which the exceptionally genial climate and fertile soils of her broad valleys and foot-hills are so admirably adapted. It has, therefore, been thought advisable to give it a more extended description than would seem warranted by the small amount of cotton that has been produced within her borders; the more so as the state is but slightly represented in the special investigations of the Tenth Census.

FRANCIS A. WALKER.

LETTER OF TRANSMITTAL.

BERKELEY, CALIFORNIA, *June* 1, 1883.

To the SUPERINTENDENT OF CENSUS.

DEAR SIR: I transmit herewith a report on the agricultural features and cotton production of the state of California, including descriptions of the individual counties, as well as of the regions; the result of the joint labors of Dr. R. H. Loughridge and myself.

Among the states included in the reports on cotton production California stands in a peculiar position, and at first sight the insignificant number of bales of the staple produced within the census year would hardly seem to entitle the state to be counted among those deserving a detailed description in this connection. As a matter of fact, however, this condition of things must properly be accounted as temporary and accidental; for cotton has been successfully grown within the state all the way from the Mexican boundary to Shasta county, and the staple produced has, on the whole, proved to be of peculiar excellence. The restricted area now given to its cultivation is the concurrent result of many causes, chief among which is the distance from any but a home market, which renders competition with the Gulf states in any other sphere impracticable. In the absence of cotton-mills, the home market has been restricted to the amount consumed by the woolen-mills within the state for the manufacture of mixed fabrics. Again, the predominance acquired at the outset by the culture of wheat and other food crops, and, in later years, by the culture of the grape and certain other fruits of which California has almost a monopoly in the United States, naturally tended to keep down the culture of a staple in the production of which there is such formidable competition by the Gulf states on the one hand and by India on the other.

Since, however, the production for the home market has steadily been maintained and has proved profitable, it is legitimate to infer that whenever, by the establishment of cotton factories on the coast, the local demand shall increase, cotton production will do the same.

There are, however, other causes that tend to commend cotton culture to the California farmer, viz, its relations to the peculiarities of the soil and climate, especially of the great valley. These points are discussed in detail under the proper heads in the body of this report, and they are sufficiently strong to render it probable that cotton culture will rapidly increase hereafter in the state.

The compilation of reliable descriptions of the several regions and counties of California has been beset with unusual difficulties. In the case of other states we have in most cases had the basis of a state survey, or of somewhat extensive personal explorations made under the auspices of the Census Office. In the case of California, the latter source has, for cogent reasons, been restricted to three short excursions made by myself to the southern and northern portions of the great valley and one by Mr. Herman Partsch to the region of the Salinas valley. The volumes of the California state survey are almost totally barren of information on agricultural topics, and even that relating to the topographical features can be utilized mainly as furnishing links in the chain of broader evidence. In this respect the report unfortunately does not stand alone among those of state surveys; but in consequence of the stoppage of the work in 1872 probably much of the practical matter has thus far remained unpublished. Since my arrival in the state (1875) I have vainly endeavored to revive at least the agricultural portion of the survey; but the failure to obtain from the legislature any funds applicable to field-work has compelled me to remain content with such information as could be obtained through correspondence and from specimens of soils, rocks, etc., transmitted by interested persons, for examination and report by the agricultural department of the

University of California, under a small provision made therefor by the university. In the course of time this work has furnished important information regarding the composition of the soils of the state; but little of a systematic character could be done until, upon the request of the Superintendent of Census, the authorities of the Central Pacific railroad, under the initiative of the late B. B. Redding, then in charge of its land-office, detailed an intelligent engineer, Mr. N. J. Willson, to collect soil specimens from the several stations on the main lines in the great valley from Redding to Bakersfield, and thence through Los Angeles and San Bernardino counties to Yuma. These specimens, numbering about 350, and the notes accompanying them at least from the southern division, have been the source of a great deal of important information, as will be seen from the abstracts added to the descriptions of the southern valley counties. Mr. Willson's notes from the northern part of his route were unfortunately not received. Of these specimens, and of others collected by myself and Mr. Partsch, twelve representative ones were selected for analysis, the work being done at the expense of the Census Office. Subsequently a larger number were analyzed, in the course of the regular work of the agricultural department of the university, in time for introduction into this report.

A number of other soils, with accompanying reports on the regions of their occurrence, were also received, in response to a circular issued by a commission informally constituted in advance of expected legislative action on the representation of California at the Paris exhibition of 1879. The legislative support was refused, and the reports, some of which were quite lengthy and exhaustive, remained unused until now. Abstracts of them have been added to the descriptions of the counties concerned.

Apart from these direct sources of information, such publications heretofore made as include descriptions of the whole or parts of the state—books, pamphlets descriptive of counties, and newspaper articles—have been drawn upon, and doubtful or irrelevant statements have been carefully eliminated as far as possible. This work has been a matter of no little difficulty and patient research, and has almost wholly fallen to the part of Dr. Loughridge. It is not a little singular how few of these descriptions, purporting to give the agricultural features for the benefit of possible settlers, do actually convey a definite idea of the country described. In the great majority of cases the writers deal largely in generalities concerning the results of farming operations, leaving the aspect of the country, the kinds of soil and their several areas of occurrence, and other matters of first interest, to mere conjecture or inference; a practice in which, as I have reason to know, California writers do not stand alone. To gather the natural facts from the mass of miscellaneous statements and combine them into a connected picture is often arduous work, and cannot always be successful in the absence of some personal knowledge. Still, such as they are, the descriptions hereinafter given will probably convey a better and more generally correct conception of the features of California than has heretofore been given to the public.

Prominent among the sources of information drawn upon are the following published works:

The Natural Wealth of California, by T. F. Cronise. 1868.

The Resources of California, by Theo. S. Hittell. 1874.

California As It Is, by seventy leading editors and authors. Published by the San Francisco Call Company. 1882.

Report of the Geological Survey of California, by J. D. Whitney. Geology. 1865.

The above are works of a general character, covering to a greater or less extent the entire state. The following treat only of special parts or topics:

Reports of the State Engineer (William Hammond Hall) on drainage, improvement of rivers, the flow of mining detritus, and the irrigation of the plains. Sacramento, 1880. This is a most important document, from which the greater part of the data regarding the rivers and irrigation in the San Joaquin valley and in the Los Angeles region is derived and is largely literally copied. Important data regarding the soil areas in the latter region has also been directly furnished from the state engineer's office for the agricultural map.

Reports of the Agricultural Department of the University of California for 1877, 1879, 1880, and 1882. From these is extracted nearly all the matter relating to the character and composition of soils, alkali soils, and irrigation waters.

Report on the Climatic and Agricultural Features and the Agricultural Practice and Needs of the Arid Regions of the Pacific Slope, by E. W. Hilgard, T. C. Jones, and R. W. Furnas; made under the direction of the Commissioner of Agriculture, 1882. The portions of this report relating to climate, irrigation, and other general topics have, to a considerable extent, been recast for the present one.

For the tables of rainfall and temperatures we are largely indebted to the observations made under the auspices of the Central Pacific railroad, which have been conveniently tabulated by the *Pacific Rural Press.*

Besides the above, numerous locally published "county descriptions" have been utilized, as also letters from correspondents found in the columns of the *Pacific Rural Press*, the *San Francisco Bulletin*, and other transient publications and county papers. Special points have also been elucidated by direct correspondence and verbal inquiry. It is, of course, almost impossible to give credit separately to all these numerous sources, and it has only been done where literal extracts have been made.

For the soil map accompanying this report the first basis has been the altitude map by Mr. Henry Gannett, 1877. Its outlines have, however, been materially modified at many points for our purposes from information obtained from detailed maps of some of the counties, as well as from personal observation. These county maps, for the inspection of sets of which we are indebted to the California Immigration Association and the Grangers' Bank, of San Francisco, have supplied many valuable data. The maps of the geological survey have also been fully utilized.

The arrangement of subjects in this report is substantially the same as in those preceding it, viz: first the tables of population and production, which in this case show less of actual cotton production than of the great variety of crops grown; next, a general summary of the physico-geographical and climatic features, followed by the general description of the agricultural regions and history and discussion of cotton production in California, forming Part I. Part II includes the descriptions of counties, while the cultural details, usually placed under Part III, are here included under the discussion terminating Part I, in which connection they are most readily understood.

All of which is respectfully submitted.

E. W. HILGARD.

TABULATED RESULTS OF THE ENUMERATION.

AREA, POPULATION, TILLED LAND, AND LEADING CROPS.

AREA, POPULATION, TILLED LAND, AND LEADING CROPS OF CALIFORNIA.

Counties.	Land area.	POPULATION.		TILLED LAND.			ACREAGE AND PRODUCTION OF LEADING CROPS.								Vineyards.
		Total.	Average per square mile.	Per cent. of area.	Acres.	Acres per square mile.	Wheat.		Barley.		Corn.		Oats.		
							Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.	Acres.
	Sq. mls.														
The State	155,980	864,694	5.5	6.6	6,602,102	42.4	1,882,429	29,017,707	586,350	12,463,561	71,781	1,993,325	49,947	1,341,271	35,539
GREAT VALLEY REGION.															
Butte	1,720	18,721	10.9	27.7	304,677	177.1	127,189	2,244,770	23,288	516,474	1,325	31,210	418	13,700	570
Colusa	2,500	13,118	5.2	40.8	653,016	261.2	261,381	4,537,504	39,939	899,558	851	15,735	176	3,600	14
Yuba	700	11,284	16.1	24.7	110,839	158.3	28,134	359,967	11,057	218,458	603	12,220	1,461	23,210	618
Sutter	580	5,159	8.9	46.3	171,856	296.3	74,338	1,205,883	14,830	365,086	1,596	28,935	243	5,916	169
Yolo	940	11,772	12.5	46.4	278,963	296.6	115,369	2,086,550	18,320	519,479	714	10,090	55	1,480	757
Solano	940	18,475	19.7	46.3	278,596	296.3	107,588	2,042,533	32,222	571,493	443	16,685	127	2,015	1,638
Sacramento	1,000	34,390	34.4	47.6	304,627	304.6	44,123	804,631	30,547	650,448	3,928	149,550	871	22,745	1,938
San Joaquin	1,360	24,340	17.9	52.9	460,342	338.4	201,461	3,529,511	32,669	796,409	2,333	68,890	130	2,820	674
Stanislaus	1,420	8,751	6.2	45.9	417,511	294.0	172,445	1,642,892	19,559	312,862	378	13,655	.....	.....	99
Merced	2,280	5,656	2.5	19.0	277,689	121.7	67,975	296,308	10,181	88,036	574	15,715	25	30	178
Fresno	8,000	9,478	1.2	5.6	291,087	36.3	20,474	190,923	9,504	118,527	414	10,053	9	205	471
Tulare	5,610	11,281	2.0	5.6	200,650	35.7	28,131	371,081	3,661	69,200	2,535	46,255	6	160	309
Kern	8,160	5,601	0.7	1.2	61,497	7.5	6,887	85,682	6,151	119,571	1,694	35,046	80	2,400	68
Total	35,210	178,035	5.5	16.9	3,811,370	108.2	1,255,495	19,398,235	251,928	5,245,621	17,388	454,039	3,601	78,281	7,503
LOWER FOOT-HILL REGION.															
Shasta	4,000	9,492	2.3	2.1	55,915	13.9	6,267	90,610	6,762	87,303	53	1,590	677	22,039	113
Tehama	3,060	9,301	3.0	13.8	270,441	88.3	84,254	1,386,228	14,967	261,338	24	750	298	9,114	39
Nevada	990	20,823	21.0	4.0	25,207	25.6	304	3,235	543	10,632	32	665	1,165	26,871	107
Placer	1,480	14,232	9.6	10.8	101,923	68.8	11,751	183,547	5,594	68,275	160	4,879	873	14,524	1,086
El Dorado	1,800	10,683	5.9	2.9	33,949	18.8	1,360	20,777	1,137	22,911	13	414	57	1,168	1,415
Amador	540	11,384	21.1	10.6	36,785	68.1	2,386	48,323	3,291	101,054	1,191	46,695	31	822	580
Calaveras	980	9,094	9.3	4.7	29,414	30.0	807	16,256	1,926	47,294	206	7,295	13	330	328
Tuolumne	1,980	7,848	4.0	1.9	23,861	12.0	4,055	62,824	2,558	41,618	24	373	69	1,885	418
Mariposa	1,560	4,339	2.8	1.5	15,125	9.6	337	4,476	1,314	26,239	30	720	12	255	43
Total	16,390	97,196	6.0	6.8	592,620	36.2	111,521	1,825,276	38,092	666,564	1,739	57,381	3,195	77,008	4,079
SOUTHERN REGION.															
Los Angeles	4,750	33,381	7.0	6.4	195,055	41.0	29,349	316,042	38,823	405,708	22,771	752,104	78	1,470	4,161
San Bernardino	23,000	7,786	0.3	0.2	25,601	1.1	2,558	45,582	4,076	82,563	774	23,136	.....	.....	1,215
San Diego	14,600	8,618	0.6	0.4	38,247	2.6	8,929	60,650	3,573	45,330	440	8,017	77	953	224
Total	42,350	49,785	1.2	0.9	258,903	6.1	40,836	422,274	46,472	533,601	23,985	783,257	155	2,428	5,600
COAST RANGE REGION.															
South of the bay region.															
San Francisco	40	233,959	5,849.0	8.9	2,298	57.4	.....	.....	349	3,500	.....	.....	44	440	1
San Mateo	440	8,669	19.7	26.3	73,986	168.1	10,767	219,684	16,705	349,644	118	1,380	7,376	132,473	39
Contra Costa	800	12,525	15.6	45.5	232,794	290.9	71,870	1,267,016	19,674	501,880	55	1,360	1,280	37,455	325
Alameda	660	62,976	95.4	47.4	200,360	303.5	36,032	620,758	39,075	1,213,820	1,139	37,573	1,458	32,766	344
Santa Clara	1,400	35,039	25.0	18.5	166,184	118.7	38,623	648,055	29,613	716,860	261	10,391	260	4,771	1,532
Santa Cruz	420	12,802	30.5	15.0	40,205	95.7	12,060	291,049	5,945	176,804	1,768	43,873	934	21,513	346
Monterey	3,520	11,302	3.2	7.5	168,862	48.0	69,022	779,286	35,426	825,550	498	14,978	3,363	88,362	10
San Benito	990	5,584	5.6	14.2	90,590	91.5	32,223	837,271	10,469	192,462	299	6,720	41	846	62
San Luis Obispo	3,460	9,142	2.6	8.0	177,598	51.3	10,618	173,531	9,658	205,869	458	13,503	937	13,405	56
Santa Barbara	2,200	9,513	4.3	7.7	108,749	49.4	18,492	265,955	13,598	245,667	3,167	123,795	24	330	77
Ventura	1,690	5,073	3.0	7.5	81,107	47.9	8,479	113,497	28,171	551,289	9,121	148,485	40	300	134
Total	15,620	406,584	26.0	13.4	1,342,733	85.9	308,186	5,215,502	208,683	4,983,345	16,874	402,058	15,757	332,661	2,926
North of San Pablo bay.															
Marin	580	11,324	19.5	5.8	21,357	36.8	2,603	55,520	1,499	37,554	.....	.....	1,031	26,937	40
Sonoma	1,520	25,926	17.0	18.4	178,954	117.7	39,820	742,123	11,126	256,007	5,961	158,829	2,615	68,685	8,540
Napa	840	13,235	15.8	15.1	81,045	96.4	33,653	611,445	5,753	130,844	1,664	41,722	1,014	22,250	6,671
Lake	1,100	6,596	6.0	5.5	38,564	35.1	8,296	173,842	4,551	124,300	755	19,277	352	10,243	54
Mendocino	3,780	12,800	3.4	2.4	58,164	15.3	8,899	166,666	3,544	101,829	884	20,526	2,843	80,288	77
Trinity	2,490	4,999	2.0	0.3	4,830	1.9	1,071	14,185	14	220	30	980	165	3,626	3
Humboldt	3,750	15,512	4.1	2.9	69,025	18.4	3,437	84,532	2,629	94,848	624	16,313	8,817	354,785	10
Del Norte	1,540	2,584	1.7	1.0	10,678	6.9	56	995	54	1,530	42	1,710	200	4,830	4
Total	15,600	92,976	5.9	4.6	462,617	29.7	97,835	1,849,308	29,170	747,132	9,960	259,357	17,037	571,644	15,399

AREA, POPULATION, TILLED LAND, AND LEADING CROPS OF CALIFORNIA—Continued.

Counties.	Land area.	POPULATION.		TILLED LAND.			ACREAGE AND PRODUCTION OF LEADING CROPS.								Vineyards.
		Total.	Average per square mile.	Per cent. of area.	Acres.	Acres per sq. mile.	Wheat.		Barley.		Corn.		Oats.		
							Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.	Acres.
HIGHER FOOT-HILL AND SIERRA MOUNTAIN REGION.	*Sq. mls.*														
Siskiyou	5,660	8,610	1.5	1.4	50,777	9.0	6,330	98,370	3,598	114,013	112	3,015	3,268	106,359	10
Modoc	4,260	4,399	1.0	0.7	20,017	4.7	4,301	78,335	3,956	91,325	18	440	774	20,883	.....
Lassen	5,000	3,340	0.7	0.9	29,161	5.8	4,773	75,361	1,950	37,073	15	330	1,465	33,126	.....
Plumas	2,760	6,180	2.2	0.9	15,791	5.7	1,129	21,217	16	535	.....	.....	2,574	87,797	.....
Sierra	880	6,623	7.5	1.1	6,269	7.1	308	689	391	1,172	.....	.....	1,082	2,320	.....
Alpine	730	539	0.7	0.2	790	1.1	179	2,936	113	3,410	8	235	236	5,985	.....
Mono	3,400	7,499	2.2	0.1	1,190	0.3	11	200	295	3,925	.....	.....	12	250	.....
Inyo	8,120	2,928	0.3	0.3	13,864	1.7	1,525	30,004	1,686	35,845	1,682	33,213	791	22,538	22
Total	30,810	40,118	1.3	0.7	137,859	4.5	18,556	307,112	12,005	287,298	1,835	37,233	10,202	279,249	32

PART I.

PHYSICO-GEOGRAPHICAL AND AGRICULTURAL FEATURES OF THE STATE OF CALIFORNIA.

5
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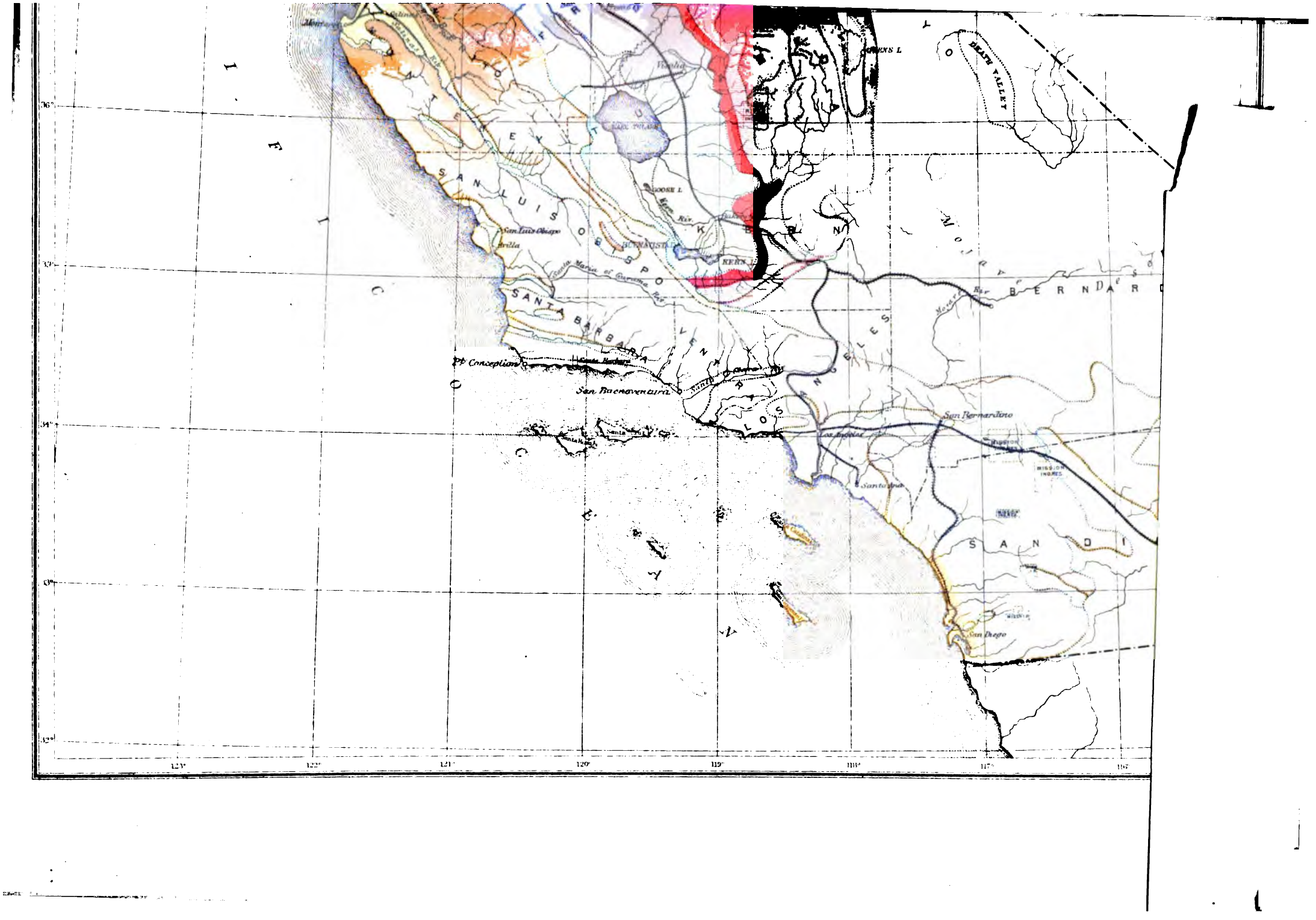

SAN LUIS OBISPO
SANTA BARBARA
LOS ANGELES
SAN BERNARDINO
SAN DIEGO
KERN
INYO
MONO
Pt Conception
San Buenaventura
Santa Barbara
Los Angeles
San Bernardino
Santa Ana
San Diego
Visalia
Bakersfield
Fresno
Monterey
Owens L
Death Valley
Tulare L
Goose L
Kern R
Mojave R
Santa Maria
Santa Rosa
Santa Cruz
Santa Monica
Pasadena
Riverside
Redlands
San Luis Obispo
Paso Robles
Salinas
Watsonville
Hollister
Gilroy
Mission Peak
Mt Diablo
Mt Hamilton
Mt Tamalpais
Point Reyes
Farallon Is
Santa Rosa I
Santa Cruz I
Santa Barbara I
Santa Catalina I
San Clemente I
San Nicolas I
San Miguel I
Anacapa I
Los Coronados
Los Coronados I
San Pedro
Long Beach
Pomona
Ontario
Colton
San Jacinto
Elsinore
Temecula
Escondido
Oceanside
Mission Indians
Indians
Pacific Ocean
123°
122°
121°
120°
119°
118°
117°
116°
39°
38°
37°
36°
35°
34°
33°
32°

DEPARTMENT OF THE INTERIOR — TENTH CENSUS OF THE UNITED STATES

AGRICULTURAL MAP

OF

CALIFORNIA

COMPILED FROM MANY SOURCES BY

R. H. LOUGHRIDGE, PH.D.

SPECIAL AGENT

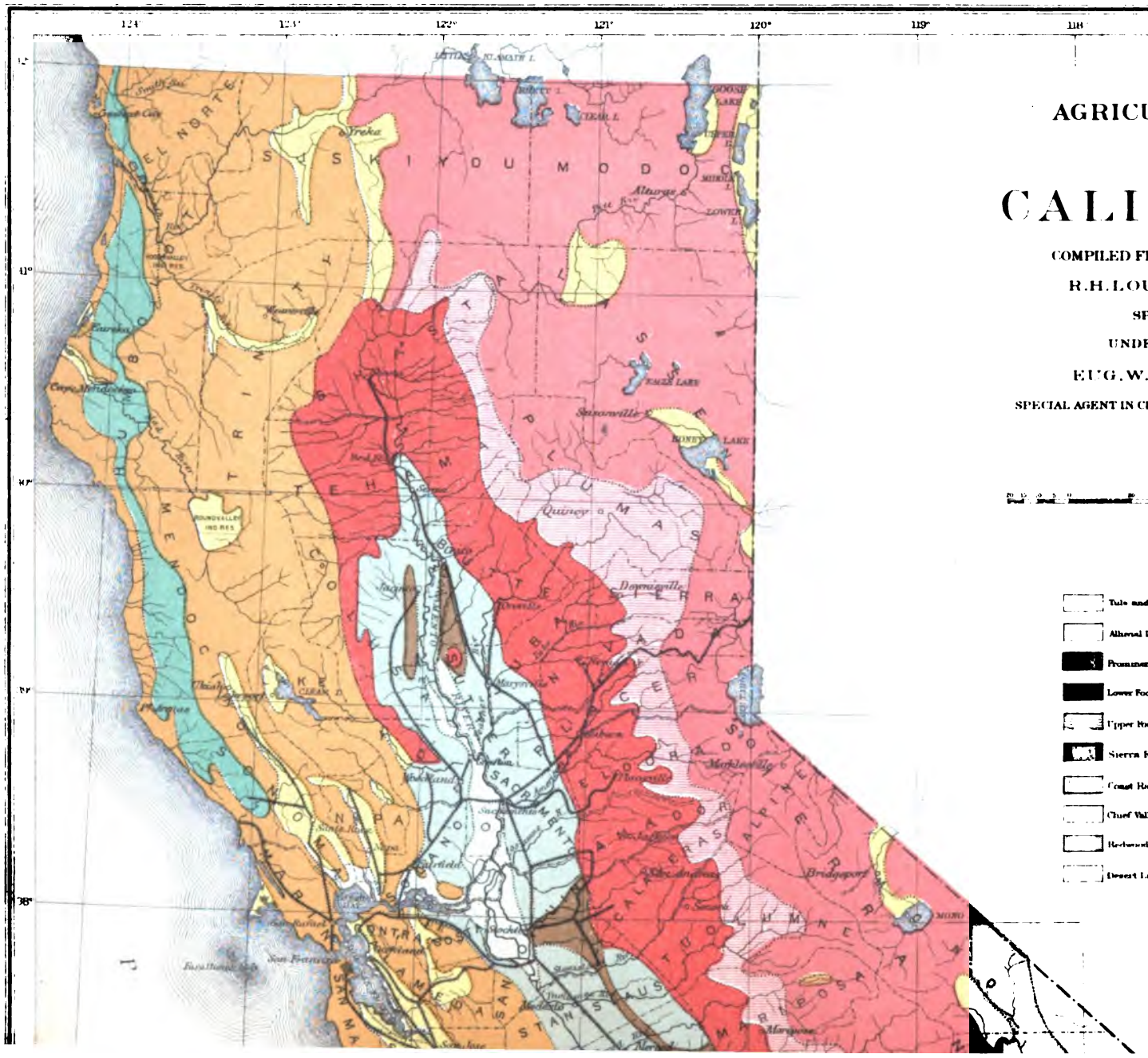
UNDER DIRECTION OF

EUG. W. HILGARD, PH.D.

SPECIAL AGENT IN CHARGE OF "COTTON PRODUCTION"

1883.

Scale



LEGEND

- Tule and Marsh Lands
- Alluvial Lands
- Prominent Adobe Lands — Great Valley
- Lower Foothills of the Sierra and Northern Coast Range (Altitude below 2000 feet)
- Upper Foothills or Broken Lands (2000 to 4000 feet)
- Sierra Region
- Coast Range
- Chief Valleys of Coast Range and Eastern slope of Sierra
- Redwood Lands of Coast Range
- Desert Lands

OUTLINE OF THE PHYSICAL GEOGRAPHY OF THE STATE OF CALIFORNIA.

The state of California lies between the parallels of 32° 30′ and 42° north latitude, thus stretching through nine and a half degrees of latitude, corresponding to the difference on the Atlantic coast between Edisto inlet, South Carolina, and cape Cod, Massachusetts. Its northern third lies between 120° and 124° 26′ west longitude, the most westerly point being cape Mendocino, whence the coast trends southeastward, with a westerly convexity, toward San Diego bay. Between the extreme northwest and southeast corners the direct distance is 775 miles. The maximum width (between point Concepcion and the north end of the Amargosa range in Nevada) is 235 miles, and the minimum width (between the Golden Gate and the southern end of lake Tahoe) 148 miles. The total area of the state is 158,360 square miles. Its land area alone is 155,980 square miles, being second only to Texas among the states and territories as now defined.

It is obvious that on this vast area the diversity of climates and of soils must be very great, and that only a very general outlining of these can be attempted within the limits of this report.

TOPOGRAPHY AND DRAINAGE.—The climates of the several portions of the state are so directly dependent upon its topographical features that an outline of these must, of necessity, precede any other discussion.

The two prominent features, extending through nearly the entire length of the state, are the snow-capped range of the Sierra Nevada on the eastern border and the low Coast range, or rather belt of ranges, bordering the sea-coast on the west. Between the two lies the great valley of California, drained from the northward by the Sacramento, and from the southward by the San Joaquin river, and these, uniting near the middle of the length of the valley, pass westward through the narrow strait of Carquines into San Francisco bay, and thence through the Golden Gate into the Pacific ocean. These two rivers receive nearly all their water from the Sierra Nevada, the streams flowing landward from the Coast range being insignificant. The main drainage of the Coast range is to seaward through many small rivers bordered by fertile valleys. The immediate coast is mostly abrupt and rocky, and frequently mountainous.

The maximum width of the great valley occurs opposite the outlet of the rivers, and in its southern portion, near the south end of Tulare lake, where it is over 60 miles. In its middle part the distance between the foot-hills of the two ranges averages about 40 miles; but to the northward these ranges gradually converge, the Coast range widening and becoming higher, while the Sierra narrows and, as a whole, becomes lower, though rising locally into the Lassen peaks, and culminating, as it merges into the coast ranges, in the great volcanic mass of Shasta. Northwestward the Siskiyou mountains form a cross range of considerable elevation, an effectual natural barrier between California and Oregon, while northeastward lies the barren "lava-bed" plateau, with its numerous lakes. The great valley, may be considered as terminating northward at Red Bluff, Tehama county, although more or less valley land, but of a different character, occurs along the Sacramento river as far north as Redding, Shasta county.

Southward the termination is much more definite, the Coast range and the Sierra being cross-connected, in a graceful sweep around Buena Vista and Kern lakes, by the Tejon range, beyond which to the eastward lies the great arid plateau of the Mojave desert. This range continues southward into the ranges of San Fernando, San Gabriel, and San Bernardino, all of which are often comprehended under the general but somewhat indefinite name of Sierra Madre, also applied far to the southward to the mountains representing the continental divide; but it would be better to comprehend the whole under the name of the San Bernardino range. Southward of this range lies the valley or plain of southern California, most of which is within the county of Los Angeles, with an outlier in the southwestern corner of San Bernardino, and is partly screened from the direct impact of the coast winds by a low coast range, the Santa Ana mountains, which is, however, traversed by the country drainage from the higher ranges. Toward San Diego county this coast range divides into a broad belt, dotted with smaller ranges and interspersed with valleys and table-lands, about 30 miles wide from the coast inland to the Mexican boundary.

Northward of the San Bernardino range lie the great Mojave and Colorado deserts, mostly high barren plateau lands, intersected by short abrupt mountain ranges, devoid of streams, and largely composed of sandy and "alkali" soils incapable of reclamation. To the northwest from the desert region numerous short water-courses descend from the steep eastward slope of the Sierra; but, although they create some fertile valleys adapted to agriculture, their volume is very small compared to the drainage of the western slope.

GEOLOGY.—Broadly speaking, the coast ranges of California consist of Tertiary and Cretaceous strata (mostly sandstones and calcareous clay shales), almost everywhere greatly disturbed, folded, and frequently highly metamorphosed, and traversed by dikes of eruptive and upheaval-axes of rocks. In the portion north of San Francisco these are frequently covered by tufaceous and scoriaceous or crystalline lava-flows, emanating from distinct volcanic vents now extinct.

In contrast to the Coast range, the Sierra Nevada has in general a central axis of granitic or other rocks (occasionally traversed by volcanic vents), on the flanks of which lie more or less crystalline and metamorphic slates or schists of Palæozoic, Triassic, and Jurassic age with edges upturned at a high angle or sometimes vertical. Abutting against this, the proverbial "bed-rock" of the California miners, there lie on the eastern border of the great valley strata of marine deposits, mostly of the Tertiary, but northward of Folsom, Sacramento county, also of the Cretaceous age, which are but slightly disturbed, and into which the rivers flowing from the cañons of the Sierra have cut their immediate valleys, flanked by bluffs from 40 to 70 feet high. From Tuolumne county northward, on the lower foot-hills, appear immense gravel beds, mostly gold-bearing, and these are partly overlaid by eruptive or volcanic outflows and tufaceous rocks, also accounted as belonging to the Tertiary age. In the northern portion of the Sierra region the eruptive rocks become more and more prominent, covering an enormous area ("the lava-bed") in the northeastern part of the state, and, as in the Cascade range, in Oregon, forming the body of the comparatively low range upon which the volcanic cone of mount Shasta is superimposed.

Apart from the Cretaceous and Tertiary beds on the borders of the great valley, there are within the valley terraces and bench-marks showing the existence in Quaternary times of a great fresh-water lake, which was subsequently drained byt he erosion or breaking, first, of the strait of Carquines, and ultimately of that of the Golden Gate. Prior to the latter event the drainage of the great valley passed through the Santa Clara and Pajaro valleys into the bay of Monterey. Borings in the interior valley disclose materials varying from fine silts to sands and gravels, evidently deposited in the ancient lake. The latest surface deposits are, in the San Joaquin valley, mostly sandy, in the Sacramento valley more commonly clayey ("adobe"), corresponding to the composition of the coast ranges themselves, which in their interior southern portion show sandy materials more prevalently, while in the middle division clay shales are predominant, and form correspondingly heavy soils.

Since the agricultural features of California depend much more upon the topography than upon any details of geological structure a more extended discussion of the latter would be out of place here. So far as relevant to the objects of this report they will be referred to in the regional and county descriptions.

WINDS.—The prevalent winds on the California coast are from the west, the influence of the Pacific ocean thus producing a climate in which the extremes of both heat and cold belonging to the several latitudes are tempered, so that on San Francisco bay and southward to Monterey the difference between the average temperatures of summer and winter is only from 6 to 10 degrees. This equalizing effect is partly cut off from the interior valley by the Coast range, which also intercepts a portion of the moisture carried by these winds; the remainder is condensed mainly on the western slope of the Sierra Nevada, thus producing the arid continental climate of the interior plateau of Nevada. In the great interior valley the general direction of these winds is changed to "up-valley", that is, to a little west of south in the Sacramento valley and slightly west of north in that of the San Joaquin, a heavy westerly breeze blowing in, as a rule, through the joint outlet of both valleys, the straits of Carquines.

North of cape Mendocino the direction of the prevailing currents is more from north of west, but south of the cape the direction is due west or slightly south of west, forming the "summer trade winds", which set in regularly some time in May and continue, with but an occasional interruption by a "norther", until October, laden with moisture from the warm, high seas. In summer these winds strike the cold Alaskan ocean current, which comes to the surface and sets in-shore off central California, producing dense fogs, which during the summer months frequently cover the coast country for twenty out of twenty-four hours for weeks together. Beyond a slight drizzle, however, no water falls; and as the fog banks drift against and up the slopes of the Coast range they dissolve quickly before the intense heat and dryness of the summer atmosphere in the great valley beyond. The moisture absorbed by the soil of the coast belt from these fogs goes far, however, toward maintaining the growth of the hardier herbaceous as well as of woody plants, no less than that of weeds, during the season of drought.

From May to October, both inclusive, south winds are very rare, but during the winter months they prevail largely, and bring the rains upon which the success or the failure of crops depend. The winter rain-storms are usually heralded by heavy weather in Oregon or in the Shasta region, whence the rain wind works backward, so to speak, until it exhausts itself in the southern part of the San Joaquin valley, where the San Fernando range seems to form a partial weather divide, leaving the Los Angeles region more or less independent of the changes to the northward. Sometimes the rain-storm works chiefly down the coast, leaving the great valley almost dry, in which case Los

Angeles and San Diego usually get a fair proportion of its benefit. Sometimes prolonged and severe storms cover the entire state and extend far into British Columbia and Arizona. As thunder and lightning rarely form a part of the atmospheric disturbance, the rain usually falls gently and continuously, rather than in torrents, and thus chiefly soaks into the ground. Sometimes a fierce south wind drives it for a day or two, and then generally there comes a change; the wind gradually veers to the westward, then more rapidly to northwest and north, and with a heavy shower the sky clears suddenly and a "norther" sets in; though not ordinarily bringing a very low thermometer, it often feels bitingly and penetratingly cold, because of its velocity and dryness, which cause rapid evaporation. Before the "norther" the surface moisture quickly disappears, muddy roads become as rough as if frozen, and compact ground cracks after a few days. Any long prevalence of this wind is looked upon with dread at all seasons, on account of the waste of moisture which it involves even when cold. In autumn and in spring, when its temperature is higher, the young grain often withers before it, and from May to September (when it is fortunately of rare occurrence) it sometimes becomes a veritable simoon, like the breath of a hot furnace, shriveling up the grain when in milk and sometimes almost curing the standing crops into hay. To the seaward of the Coast range the "norther" is rarely of long duration, three days being its ordinary limit; but in the great valley, and especially in the valley of the San Joaquin, it is both more frequent and persistent, occasionally blighting in a week all the hopes of the grain-grower not able to resort to irrigation, and even drying the fruit on the trees. East winds are only of brief and local occurrence, being ordinarily cut off by the mountain ranges in their north and south course. They are usually the precursors of a "southwester", with rain.

Outside of the mountains the velocity of the wind rarely becomes so great as to endanger any well-constructed windmills, which are therefore very generally in use as a motive power, especially for pumping water. In the absence of electrical disturbance hurricanes and "tornadoes" are scarcely known, save in the high Sierras, where local summer thunder-storms, sometimes accompanied by cloud-bursts, may be observed among the high peaks, in curious contrast to the unclouded brightness of the sky overhanging the valley.

TEMPERATURE.—The prominent characteristic of the California coast in respect to temperature is its remarkable temperateness as compared with points similarly located on the Atlantic coast. Taking stations at or near the extreme and middle points of corresponding latitude on both coasts, the comparison stands thus:

CALIFORNIA COAST.				ATLANTIC COAST.			
Stations.	Summer.	Winter.	Year.	Stations.	Summer.	Winter.	Year.
	Degrees.	*Degrees.*	*Degrees.*		*Degrees.*	*Degrees.*	*Degrees.*
Camp Lincoln	59.5	47.2	53.9	Boston, Massachusetts	68.7	28.1	48.4
San Francisco	58.0	50.1	55.2	Cape Charles, Virginia	74.3	35.8	56.0
San Diego	69.7	54.1	62.1	Edisto, South Carolina	81.0	46.6	64.3

It will be noted that while the annual averages of corresponding points on the two coasts are not very widely different, the temperatures of summer and those of winter are very much farther apart on the eastern coast than on the western, and quite as strikingly so in the northern as in the southern portion of the respective regions. This exemption from extremes of temperature constitutes one of the great attractions of the Pacific coast.

In the interior, notably in the great valley, the seasons show greater extremes of temperature, but the greater range of the thermometer is largely offset by the fact that the dryness of the atmosphere renders the changes much less sensible than is the case in the moister air of the coast. It is thus at San Francisco, which presents the extreme of the coast climate on account of its peninsular position and the access of the sea air through the Golden Gate, those familiar with the climate making a careful distinction between the sunny and the shady side of the streets in walking, and bay windows, of necessity, take the place of porticoes or porches, which would rarely be available save in the middle of the day, while in the interior porticoes are universal, and camping out under a tree all night may be indulged in with impunity by any one during the dry season.

The table on page 10 shows more in detail the difference between the coast climates on the one hand and those of the interior on the other, it being understood that in the measure in which the valleys are screened from the immediate access of the sea air and summer fogs their climate approaches in character that of the great valley.

WESTERN OR COAST DIVISION.

Station.	County.	Elevation.	Years of observation.	GENERAL AVERAGE.			MONTHLY EXTREMES.			
				Summer.	Winter.	Year.	Summer.		Winter.	
							Maximum.	Year.	Minimum.	Year.
COAST REGION, NORTH.		*Feet.*		*Degrees.*	*Degrees.*	*Degrees.*	*Degrees.*		*Degrees.*	
Camp Lincoln*	Del Norte		2	59.5	47.2	53.9				
Fort Humboldt*	Humboldt	50	16	58.2	47.0	52.9				
Camp Wright*	Mendocino		6	74.7	58.8	57.8				
COAST REGION, MIDDLE.										
Napa	Napa	95	5	70.3	49.3	59.9				
San Francisco*	San Francisco	130	11	58.0	50.1	55.2				
Oakland	Alameda	14	5	67.8	52.2	57.7	72.6	1879	49.1	1880
Martinez	Contra Costa		4	70.1	48.9	60.3	74.5	1878	42.9	1880
San José	Santa Clara	91	7	66.7	49.5	56.8	76.0	1879	42.2	1876
Santa Cruz	Santa Cruz	2,500	4	62.9	50.5	59.2	66.8	1881	46.2	1880
COAST REGION, SOUTH.										
Monterey*	Monterey	140	12	59.7	50.2	55.5				
Salinas	do		6	60.6	50.8	55.6	65.1	1877	43.9	1882
Soledad (interior)	do	3,213	6	66.9	48.8	57.8	77.3	1876	41.8	1877
Santa Barbara†	Santa Barbara	20	7	67.9	54.1	61.4	70.0	1874-'6-'7	50.4	1875
Los Angeles	Los Angeles	265	7	73.2	55.6	64.9	83.3	1876	49.9	1882
INTERIOR VALLEY.										
Riverside (R. de Jurupa)*	San Bernardino	1,000	1½	74.2	53.2	63.7				
Colton	do	965	4	80.1	50.2	65.1	86.1	1879	44.9	1882
San Diego*	San Diego	64	20	69.7	54.1	62.1				

INTERIOR AND EASTERN DIVISIONS.

NORTHERN SIERRA AND LAVA BEDS.										
Fort Jones*	Siskiyou	2,670	5	71.1	34.1	52.3				
Fort Bidwell*	Modoc	4,680	5	71.1	32.3	50.8				
GREAT VALLEY (SACRAMENTO DIVISION).										
Redding	Shasta	556	7	81.6	47.3	63.4	87.2	1879	42.5	1880
Red Bluff	Tehama	308	10	80.8	47.5	63.7	88.9	1875	39.9	1879
Marysville	Yuba	67	10	78.7	49.5	64.4	83.9	1871	44.4	1880
Sacramento	Sacramento	30	10	71.8	48.2	60.8	76.9	1876	43.0	1880
FOOT-HILLS OF THE SIERRA.										
Auburn	Placer	1,360	11	74.1	45.4	58.6	80.5	1875	39.8	1882
HIGH SIERRA.										
Cisco	do	5,934	11	60.9	32.7	45.2	73.1	1871	26.3	1880
Truckee	Nevada	5,819	11	61.1	27.7	43.3	70.3	1871	21.7	1874-'80
GREAT VALLEY (SAN JOAQUIN DIVISION).										
Stockton	San Joaquin	23	10	72.5	48.2	60.8	77.7	1872-'74	44.0	1879
Modesto	Stanislaus	91	8	78.2	47.8	63.2	85.3	1879	40.4	1881
Merced	Merced	171	9	79.1	49.0	63.4	85.1	1874	43.2	1876
Fresno	Fresno	292	5	84.1	51.3	67.6	90.0	1878	43.9	1882
Tulare	Tulare	282	6	83.8	45.9	64.4	95.2	1874	39.1	1874
Sumner	Kern	415	7	86.2	48.7	67.3	93.0	1875	41.9	1878

* From Smithsonian tables, compiled to December, 1870, from many sources, and represent calendar years.

† From record by Dr. L. N. Dimmick, Santa Barbara, January, 1871, to December, 1878.

All other tables are from observations of the Central Pacific railroad, published in the *Pacific Rural Press*, January, 1883. They represent season years (from July 1 to June 30).

As to the change in temperature in ascending the Sierra from the valley, the following statement is made by Mr. B. B. Redding in a paper read before the California Academy of Sciences in 1878: (*a*)

It has been found that the foot-hills of the Sierra up to the height of about 2,500 feet have approximately the same temperature as places in the valley lying in the same latitude. It has also been found that with increased elevation there is an increase of rainfall over those places in the valley having the same latitude, as, for instance, Sacramento, with an elevation above the sea of 30 feet, has an annual mean temperature of 60.5° and an average rainfall of 18.8 inches, while Colfax, with an elevation of 2,421 feet, has an annual mean temperature of 60.1° and an annual rainfall of 42.7 inches. This uniformity of temperature and increase of rainfall appears to be the law throughout the whole extent of the foot-hills of the Sierra, with this variation as relates to temperature, viz, that as the latitude decreases the temperature of the valley is continued to a greater elevation. To illustrate, approximately, if the temperature of Redding, at the northern end of the valley, is continued to the height of 2,000 feet, then the temperature of Sacramento, in the center of the valley, would be continued up to 2,500 feet, and that of Sumner, at the extreme southern end of the valley, to 3,000 feet.

It is curious to note that, as appears from Mr. Redding's statement, the lowest temperatures thus far observed at the two opposite ends of the valley, Redding and Sumner, are the same, viz, 27°.

a Pacific Rural Press, January 18, 1879.

It will be noted that in the southern region the difference between the summer means or between winter means, as well as between the annual means, is quite small when Santa Barbara and San Diego, both lying immediately on the coast, are compared. At Los Angeles, 20 miles inland, all these means are notably higher; still farther inland, and with increasing elevation, the summer mean rises, while the winter mean falls at Riverside, as well as more strikingly at Colton although at the latter point the annual mean is almost the same as at Los Angeles.

To convey an easily intelligible idea of some of the climatic differences indicated in the table, it may be stated that while in the great valley a few inches of snow cover the ground for a short time nearly every winter as far south as Sacramento, and snow flurries are occasionally seen even at the upper end of the San Joaquin valley, snow has fallen in the streets of San Francisco only once since the American occupation to such a depth as to allow of snowballing (which during a few hours created a state of anarchy), and only a few times has enough fallen to whiten the ground for a few minutes or hours. Hence the heliotrope, fuchsia, calla lily, and similar plants endure year after year in the open air, while at a corresponding latitude in the interior they require some winter protection. Lemon and orange trees never suffer from frost on the bay, but their fruit also rarely ripens, save in favored localities. In the interior these trees more frequently suffer from frost, but the high summer temperature matures the fruit some weeks earlier than even in the southern coast region. Cotton would, as a rule, be frost-killed in the great valley in November, while on the coast it might endure through several mild winters; but within reach of the summer fogs of the coast it fails to attain a greater height than eight or ten inches the first season, and sometimes can scarcely succeed in coming to bloom before October. Subtropical trees, which in the cotton states grow rapidly and luxuriantly, such as the crape myrtle, Paulownia, Catalpa, Mimosa (*Julibrissin*), and others, either grow very slowly or remain mere shrubs in the coast climate, while in the interior they develop as in the Gulf states. The vine flourishes near San Francisco, but fails to mature its fruit; yet it yields abundant and choice crops near San José, where the immediate access of the coast fogs is intercepted by a range of hills. It is thus obvious that, with the varying topography, the change in the direction of a valley or a mountain range, the occurrence of a gap or of a high peak in the same permitting or intercepting communication with the coast on the one hand or with the interior on the other, there exist innumerable local climates, "thermal belts," sheltered nooks, and exposed locations, each of which has its peculiar adaptations apart from soil, and the recognition and utilization of these adaptations require knowledge and good judgment and count heavily in the scale for or against success in agriculture in California.

RAINFALL.—As regards the rainfall, the prominent peculiarity throughout the state is the practically rainless summer. While it is true that rain has been known to fall in every month in the year, the average amount of precipitation during the three summer months is less than one inch in the greater portion of the state, and less than two inches even in the most favored part, viz, the counties just north of San Francisco bay. Frequently not a drop of rain falls in the interior valley and the southern region from the middle of May to November, and as the agricultural system of California is based upon the expectation of this dry weather summer rains are not even desired by the farmers at large. Northward, in the mountainous and plateau regions adjoining Oregon, the season of drought becomes shorter, as is also the case in the high Sierras, and thus there is a gradual transition toward the familiar *régime* of summer rains and occasional thunder-storms which prevails in Oregon and Washington west of the Cascade range.

Since the growing season, in the case of unirrigated lands at least, thus practically lies between November and June, and each harvest is essentially governed by the rains occurring within these limits, it is the universal and unconscious practice to count the rainfall by "seasons" instead of by calendar years; hence the current estimate of local rainfall-averages in California differs not immaterially from that of the usual meteorological tables, in which the paramount distinction between the *agriculturally* "dry" and "wet" seasons is more or less obliterated. The data hereinafter given are therefore, as a rule, "seasonal" and not "annual", and are largely those of the observations conducted along its lines by the Central and Southern Pacific railroad.

The mean annual rainfall of the greater (middle and southern) part of the state is less than 20 inches, the northern limit of that region lying between Sacramento and Marysville, in the great valley; while on the Sierras the region of rainfall between 20 and 26 inches extends as far south as the heads of King's and Kern rivers, furnishing the waters upon which depends the irrigation of the San Joaquin valley; thence southward the rain-gauge rapidly descends to 8 and 4 inches and less in the Kern valley, the Mojave desert, and the basin of Nevada.

A rapid decrease of rainfall is observed in the great interior valley. From 42 inches at Redding, at the northern end of the valley, and 24 inches at Red Bluff, 24 miles to the southward, the annual mean falls to about 19 inches at Sacramento and to 16 at Stockton. Thence southward the rainfall descends to a mean of only 10 inches at Merced, 7 at Fresno, and 4 at Bakersfield, near the southern end of the San Joaquin valley, separated only by the Tehachapi mountains from the western margin of the Mojave desert, in which the rainfall is still less.

Along the coast proper cape Mendocino bears the reputation of a kind of weather divide. Mariners expect a change of weather whenever they round this cape, and on land it marks the region where the character of vegetation begins to change rapidly from that of southern or middle California toward that of Oregon. At and immediately north of the cape the rainfall reaches an annual mean of 40 inches. A short distance southward, at point Arenas, the annual fall is 26 inches; and from 23 to 21 inches in the region of San Francisco, it falls to 16 inches at Monterey and Santa Barbara, 12 at Los Angeles, and 9 at San Diego.

Northward of cape Mendocino the rainfall increases rapidly, rising to over 70 inches in the northwestern corner of the state. Inland from the coast the increase is less rapid, but the rainfall rises at points in the Shasta region to as much as 108 inches in some years. Southward the region of rainfall exceeding 20 inches extends in the Coast range slightly farther south than in the great valley, so as to include all but the most southerly portions of the counties of Sonoma, Napa, and Marin. Southward of San Francisco again a region of more abundant rainfall includes the western Santa Clara valley, Santa Cruz mountains, Monterey bay, and the lower Salinas valley, where from 13 to 16 inches fall annually.

Ascending the Sierra from the great valley there is a rapid increase of rainfall, which, from data furnished by the records of the railroad, may be estimated at 1 inch for every 100 to 150 feet of ascent.

The following tables show more in detail the rainfall averages for representative points, the data being derived mainly from the observation made under the auspices of the Central and Southern Pacific railroad, and given for "seasons" reaching from July to June, inclusive. The data derived from the Smithsonian tables are marked by an asterisk, and refer to ordinary annual instead of seasonal means:

WESTERN OR COAST DIVISION.

Station.	County.	Elevation.	Years of observation.	Average.	Maximum.	Year.	Minimum.	Year.
COAST RANGE, NORTH.		*Feet.*		*Inches.*	*Inches.*		*Inches.*	
Camp Lincoln*	Del Norte	.....	2	73.4	.....	.....	.....	.....
Fort Humboldt*	Humboldt	50	16	35.9	.....	.....	.....	.....
Camp Wright*	Mendocino	.....	6	43.9	.....	.....	.....	.....
COAST RANGE, MIDDLE.								
Napa	Napa	95	5	26.6	34.7	1877–'78	17.1	1881–'82
San Francisco*	San Francisco	130	10	20.7	32.1	1877–'78	8.8	1876–'77
Oakland	Alameda	14	5	20.6	29.3	1877–'78	9.6	1881–'82
Martinez	Contra Costa	.....	4	16.1	19.7	1880–'81	12.9	1881–'82
San José	Santa Clara	91	8	11.4	19.3	1877–'78	5.0	1876–'77
Santa Cruz	Santa Cruz	2,500	5	26.4	39.2	1877–'78	22.0	1878–'79
COAST RANGE, SOUTH.								
Monterey*	Monterey	140	12	15.7	.....	.....	.....	.....
Salinas	do	.....	9	12.8	23.7	1877–'78	3.9	1876–'77
Soledad (interior)	do	3,213	8	7.9	15.3	1875–'76	2.7	1876–'77
Santa Barbara†	Santa Barbara	20	11	16.2	31.5	1877–'78	4.5	1876–'77
Los Angeles	Los Angeles	265	7	12.0	21.9	1875–'76	4.6	1876–'77
INTERIOR VALLEY.								
Riverside (R. de Jurupa)*	San Bernardino	1,000	1½	13.6	.....	.....	.....	.....
Colton	do	965	6	8.2	14.5	1877–'78	5.9	1876–'77
San Diego*	San Diego	64	20	9.3	.....	.....	.....	.....

INTERIOR AND EASTERN DIVISION.

NORTHERN SIERRA AND LAVA BEDS.								
Fort Jones*	Siskiyou	2,570	5	21.7	.....	.....	.....	.....
Fort Bidwell*	Modoc	4,680	5	20.2	.....	.....	.....	.....
GREAT VALLEY (SACRAMENTO DIVISION).								
Redding	Shasta	556	7	42.1	60.0	1877–'78	25.4	1881–'82
Red Bluff	Tehama	308	10	24.0	52.7	1877–'78	13.6	1874–'75
Marysville	Yuba	67	11	17.8	26.9	1873–'74	12.2	1876–'77
Sacramento	Sacramento	30	32	18.7	25.5	1875–'76	9.2	1876–'77
FOOT-HILLS OF THE SIERRA.								
Auburn	Placer	1,360	11	34.0	44.3	1875–'76	18.9	1876–'77
HIGH SIERRA.								
Cisco	do	5,934	11	60.8	82.7	1880–'81	34.1	1876–'77
Truckee	Nevada	5,819	11	34.1	44.0	1871–'72	18.0	1876–'77
GREAT VALLEY (SAN JOAQUIN DIVISION).								
Stockton	San Joaquin	23	32	15.8	30.6	1871–'72	7.2	1876–'77
Modesto	Stanislaus	91	11	9.6	13.4	1875–'76	4.3	1876–'77
Merced	Merced	171	10	9.7	12.7	1875–'76	3.2	1876–'77
Fresno	Fresno	292	5	7.0	8.9	1877–'78	4.9	1878–'79
Tulare	Tulare	282	8/	6.2	10.0	1880–'81	3.1	1878–'79
Sumner	Kern	415	7	4.2	8.0	1877–'78	1.3	1878–'79

* From Smithsonian tables, compiled to December, 1870, from many sources, and represent calendar years.

† From the records of Shaw, Bowers, and Tebbetts, Santa Barbara, from 1867 to 1868.

All other tables are from observations of the Central Pacific railroad, published in the *Pacific Rural Press*, January, 1883. They represent season years (from July 1 to June 30).

Were the rainfalls of 20 inches and less distributed over the whole or even the greater part of an ordinary season of the temperate zone, it would be altogether inadequate for the growing of cereal or other usual crops of that zone; but since in California nearly the whole of it usually falls within six months (November and April inclusive), and by far the greater part within the three winter months, during which a "growing temperature" for all the hardier crops commonly prevails, it becomes perfectly feasible to mature grain and other field crops before the setting in of the rainless summer, provided only that the aggregate of moisture has been adequate and its distribution reasonably favorable. The grain sown into the dust of a summer-fallowed field begins to sprout with the first rain, and thenceforward grows more or less slowly, but continuously, through the winter; it is ready to head at the first setting in of warm weather, from the end of March to May, according to latitude, and becomes ready for the reaper from the end of May to the end of June. Once harvested, the grain may be left in the field for several months, thrashed or unthrashed, without fear of rain or thunder-storms. As a matter of course, the grain-grower may also, at his option, sow his grain at any time after the beginning of the rains, and good crops are sometimes obtained from sowings made late in February. Usually, however, the late-sown grain is cut for hay when in the milk, in April and May, for since meadows can form no part of the agricultural system, except where irrigation is feasible, the hay grasses commonly grown in the eastern states are available only to a limited extent, and wheat, barley, and oats take their place. Again, there is no strict distinction or limit between fall and spring grain, since the sowing season extends from October to February. Thus the winter months are a very busy season for the farmer in California, as he has to watch his opportunity for putting in his crop between rains. The time between laying-by and harvest is nearly filled up by gardening and haying operations. The latter are occasionally interrupted by one or two light showers, rarely enough to injure the quality of the hay. Protracted rainy spells or thunder-storms, calling for hasty gathering of the cut grain into shocks, are unknown in harvest time, as are also sprouted or spoiled grain, except when the sacked grain is left out in the fields so late as to catch the first autumn rains. It will thus be seen that midsummer finds the California grain-grower comparatively at leisure.

But while the culture of hardy plants of rapid development was the first and most obvious expedient resorted to by the American settlers in order to utilize the fertile soils of the region of rainless summers, that of selecting culture plants adapted to arid climates was the one naturally suggesting itself to the missionary padres, who brought with them from the Mediterranean region of Europe the vine, the fig, the olive, the citrus fruits, as well as from the adjacent portions of Mexico the culture of cotton, to which, however, but little attention was given by them, the growing of wool being better adapted to the temper of their native laborers. And as they relied largely on irrigation for the success of their annual crops, it was only in very extreme cases that a deficient rainfall so affected their interests as to give the fact a place in their records.

Variation and periodicity of rainfall.—While the means of rainfall given above will not vary widely when any large numbers of years are taken together, the variations from one year to another are often sufficiently great to tempt many to invest heavily in putting in crops on the chances of a favorable season, which would bring a fortune at one venture, but sometimes results in a total loss, and consequent ruin to the investor. Such cases of agricultural gambling were at one time not uncommon in the San Joaquin valley especially, the turning point of profit or loss being a single light shower at the critical time or the occurrence of a norther for a day or two. Much ingenuity has been spent in trying to forecast the weather for the season in time to determine the chances of success; but it will generally be found that the oldest citizen, if he is candid, will be far more reserved in his opinions than later comers. However steady and reliable the summer climate may be, that of a California winter is most difficult to forecast from day to day and from week to week; and, while there are certain rules that are ordinarily counted upon, the cases where "all signs fail" are very frequent and surprises are abundant. A discussion of the observations made from 1849 to 1877, by Dr. G. F. Becker, late of the University of California, and now of the United States geological survey, seems to indicate as probable a cycle of thirteen years between extreme minima or drought years, and some data I have since obtained from the records of the missions seem to confirm still further this conclusion. The first minimum within the time of the American occupation of California occurred in the season of 1850–'51, when the rainfall at San Francisco (where the mean is 23½ inches) was only 7.4, while it had amounted to 33.1 the year before; the second minimum occurred in 1863–'64, when the rainfall at San Francisco was 10.1 inches; and the third was the season of 1876–'77, with 10 inches. The next succeeding season of minimum would be that of 1889–'90.

The following table, given by Dr. Becker, exhibits these facts, as also the probabilities deduced for the intervening years, from a discussion of the nature of the curves representing the observations: (*a*)

Observations, periodicity, and probabilities of rainfall, San Francisco.

[Tennent's gauge.]

Seasons.	Rainfall.	Seasons.	Rainfall.	Position in period.	Probabilities for the years.
	Inches.		*Inches.*		*Inches.*
1850–'51	7.40	1863–'64	10.08	I	11.50
1851–'52	18.44	1864–'65	24.73	II	20.50
1852–'53	35.26	1865–'66	22.93	III	27.40
1853–'54	23.87	1866–'67	34.92	IV	30.50
1854–'55	23.68	1867–'68	38.84	V	28.30
1855–'56	21.66	1868–'69	21.85	VI	23.30
1856–'57	19.81	1869–'70	19.31	VII	19.30
1857–'58	21.88	1870–'71	14.10	VIII	19.60
1858–'59	22.32	1871–'72	34.71	IX	25.00
1859–'60	31.22	1872–'73	18.02	X	28.20
1860–'61	19.72	1873–'74	23.98	XI	28.50
1861–'62	49.27	1874–'75	18.40	XII	28.50
1862–'63	13.62	1875–'76	26.01	XIII	19.00
Totals	308.15		307.88		309.60
1849–'50	33.10	1876–'77	10.00		

Similar tables for Sacramento and Stockton exhibit the same general features.

From information kindly furnished me by H. H. Bancroft, esq., of San Francisco, it appears in the records of the early explorers of California that the year 1805 is known as "El año del hambre" (the year of the famine), the drought having been extraordinarily severe, and nearly the same account is given of the year 1817. It will be observed that these dates indicate a period of twelve years between themselves, and that the interval from the last-mentioned date to 1877 (for whose drought years as yet no data have been found) is also divisible by the same number. It is quite intelligible that as the result of several concurrent and variable causes the period may vary between such limits as twelve and thirteen.

Should further observations confirm the existence of this definite periodicity, the forecast, even to this extent, would be of immense service to agriculture in California, since the nature of the crops, as well as their treatment, could, in a measure, be adapted to the circumstances of these "lean years". Still, the portion of the valley lying south of Stockton will always be a region of predominant irrigation, while in the northern portion a proper and intelligent co-adaptation of crops and soils can render agriculture more or less independent of that necessity. As the matter now stands, it is estimated that in the southern portion of San Joaquin county one good crop out of three may be made without irrigation, while south of Merced one in five is about all that can be counted on in the undulating uplands bordering the foot-hills. Other things being equal, much of course depends upon the nature and depth of soil, the perfection and depth of tillage, and the practice of after-cultivation as against broadcasting. To guard against the effects of northers, and to prevent all avoidable evaporation of the precious moisture, it is the universal practice to roll the grain-fields as late as it can be done without injury to the growing grain. On sandy soils this can hardly be overdone; but on clay soils, should they be too wet when rolled, the effect will be the exact reverse of what is desired, and great injury often results.

It is the general estimate that whenever the rains have been adequate to make the moisture from above meet that rising from below a crop may be secured if the season be reasonably favorable; and since, other things being equal, the depth at which moisture is found at the end of the dry season will depend upon the amount of rainfall during the previous season, it makes a material difference whether a droughty season has been preceded by a wet one (as was the case in 1850–'51), or whether a scant rainfall preceded a deficient one. In the middle portion of the valley the summer's drought will reach on untilled soils to the depth of from 3 to 5 feet, according to the nature of the soil, and this mass has to be remoistened fully to that depth to give promise of success for field crops. When on the contrary, the surface has been kept in a state of good tilth during the summer ("summer fallowed"), the moisture will be found at a much less depth, the remoistening by the fall rains will be proportionally more rapid, and the chances for a crop will be materially increased from that cause alone.

In the extreme south of the San Joaquin valley the annual rainfall rarely moistens the soil to a greater depth than 2 or 3 feet, and in digging or boring wells in districts not irrigated the materials are found dry as dust to the depth of 40 feet and even more. At the first beginning of irrigation this entire mass has to be moistened before moisture will permanently remain within reach of the tap-roots of plants, and a very large amount of water is therefore at first required; but gradually the ground fills up, the water-table, and with it the plane of sensible moisture, rises more or less rapidly, the effect becoming perceptible at the distance of many miles in the porous soils of the plains, and ultimately the amount of water annually needed for irrigation becomes a small part of that needed during the first years.

a See Bulletin No. 31 of the University of California, February, 1878.

Irrigation in California.—Since the greater part of the state of California lies within the limits of the "arid" region as defined by Major Powell,(*a*) viz, a region having a rainfall of 20 inches and less, and within which successful agriculture is, as a rule, dependent upon irrigation, a discussion of the general aspects of this subject must of necessity precede any detailed presentation of the agricultural features and practice.

As has been before noted, the peculiar mode of distribution of the rainfall through the season—nearly all falling from November to May, and during the prevalence of a growing temperature for the hardier field crops, such as cereals and grasses—permits the full maturing of crops of rapid development before the setting in of the summer drought, at least in the more northern part of the region of scanty rainfall. In the warmer southern portions, where the evaporation is greater, a larger supply of water is necessary to insure crops; but, as the tables show, these portions have a scantier rainfall. Hence the necessity for irrigation becomes rapidly greater as we advance southward, and finally absolute, at least in the valleys. The lands lying near high ranges, and especially to the westward, are agriculturally favored by a greater precipitation, due to the condensation of moisture by such mountains, but the immediate coast, as well as the foot-hills of the Sierra, is less dependent upon irrigation than the plain of the great valley.

The commanding importance of the subject of irrigation in the state of California has repeatedly secured for it legislative attention, but no general measures toward ascertaining the resources of the state in lands and waters adapted to irrigation were taken prior to the year 1878, when an act was passed providing for the appointment of a state engineer, whose duties were defined to be, "under the direction of the governor, to investigate the problems of the irrigation of the plains, the condition and capacity of the great drainage lines of the state, and the improvement of the navigation of rivers." A succeeding portion of the act imposes the duty of inquiring into and reporting upon "the question of the flow of *débris* from the hydraulic mines into the streams, and the injury to agricultural lands by the flow of *débris* thereon".

Between 1878 and 1880 the work on both of these important branches of inquiry was actively prosecuted under the able direction of Mr. William Hammond Hall as state engineer, and in January, 1880, he submitted to the legislature, then in session, his first report, a highly important document. Most of the numerical data hereinafter given are taken from this report. Unfortunately, the agitation in regard to the mining *débris* question, which has increasingly irritated the public mind ever since the passage of the act providing for the building of dams to impound the tailings of the hydraulic mines, has overshadowed the irrigation problem for the past two years, and caused a curtailment of the appropriation available for that branch of the work.

The prominent point brought out in this litigation that has vexed the courts for several years past is the irrepressible conflict between the provisions of the common law on the subject of riparian rights and the requirements of agriculture in a region requiring irrigation. The declaration of the former that every riparian owner is entitled to the undiminished volume of the stream (intended evidently for the safeguarding of the interests of the uses of water-power) strikes at the very foundation of the use of water for irrigation purposes, and is thoroughly incompatible with such use, and, therefore, with the very existence of agriculture in the arid region; yet this law has been invoked again and again in California by riparian owners claiming the undiminished volume of the streams from those above them, while fully intending to use it freely on their own lands. The courts of the state have been embarrassed by the conflict of the acknowledged foundation of American civil law with the manifest equities of the cases before them. Decisions lately made, however, distinctly affirm that the common-law doctrine is not in this respect applicable in irrigation districts.

The control of water now used in irrigation ditches in California is almost altogether based upon the right of "prior appropriation", in pursuance of custom rather than law; a method not without its merits in respect to the promotion of irrigation enterprises, but liable to gross abuse in forestalling, since it places it within the power of the appropriator to carry the water to lands in which he is interested to the detriment even of riparian owners, who, under the common law, are entitled only to so much water as they require for household and stock, but not for irrigation. The forestalling, by means of the pre-emption, homestead, or timber privileges, of all the water-supply from springs available during the dry season has in California created a situation in which many such pre-emptors of 160 acres are, as a matter of fact, "lords of all they survey," since no one can occupy the adjacent lands without paying them tribute for water supply; and this is still more emphatically true of owners of large tracts, Spanish and Mexican grants, etc., which were usually selected originally because commanding water supply.

It is difficult to foresee how the many claims or rights acquired under this system in California can now be adjusted in accordance with the public interest without a severe wrenching of what it is usual to consider "vested rights"; but it will obviously become necessary to resort to the state's ultimate right of eminent domain in condemning the water available for irrigation to public use, under such regulations as will inure to the greatest good of the greatest number. In framing these measures it should not be forgotten that irrigated land is much more valuable and productive than that which is dependent upon the accidents of the seasons, not only because of its exemption from the risks and failures involved in the cultivation of unirrigated land even in the "humid" portions of the world, but also because of the important part taken by the solids dissolved or suspended in the irrigation water in

a See my article on the soils and agriculture of California, by E. W. Hilgard, in the report of the department for 1878, p. 478.

increasing and maintaining the fertility of the soil. The irrigator is exempted from the necessity of supplying manure to restore the soil ingredients withdrawn by his crops to an extent varying in different localities, but always taking the form of a very tangible balance in his favor, in some cases (as in that of the valley of the Nile for ages past) amounting to a complete relief from all consideration of the question of the maintenance of fertility, which is intruding itself more and more urgently into the calculations of American farmers and threateningly confronts every tiller of the soil in the Old World.

These considerations justify the adoption of a much smaller unit for the farm in irrigation districts, the more complete and systematic utilization of the soil's powers enabling a smaller area to subserve the needs of a family. The unit of 80 acres, as suggested by Major Powell, instead of the usual 160, is certainly amply large in soils of any reasonably adequate native fertility; for in the irrigated colonies of southern California 20-acre lots are the usual homestead units on which industrious families make a fair living.

In these points of view may also be found a partial answer to the question frequently asked, what inducement is there for the settler to occupy the regions, laboring, apparently, under so many natural disadvantages, when so much fertile land remains unoccupied in more favored regions? From an abstract point of view the question seems difficult to answer, but concretely the explanation lies in the fact that human nature *will* take risks where there is a reasonable chance of success, as is the case in humid climates; whereas in the arid regions, success being impossible without irrigation, but becoming a certainty with it, farming becomes a much more safe, satisfactory, and paying occupation. If, on the other hand, we inquire why it is that the abundant water supply of the humid regions is not utilized with the same view of reducing the success of crops to a certainty, instead of risking the disastrous failures that afflict them from time to time in the occurrence of droughts, we can but point to that same principle of human nature which renders gambling so dangerously attractive and drives the "prospector" to continue in the search for new mines, rather than to settle down to the working of those he has already discovered.

Aside, however, from these considerations, the treelessness of irrigation countries is in itself not a slight advantage to the settler of small means, since it relieves him from the necessity of incurring the great expense and delay of "making a clearing"; an operation often involving in humid climates an expenditure altogether out of proportion with the productive value of the land. In the great valley of California, as in the prairies of the West, the plow can be put into the land without any preliminaries; but there is no heavy sod, necessitating the use of correspondingly heavy draft, the first plowing being nearly as easy as the later ones.

In climates having a long growing season, so far as temperature is concerned, the effects of irrigation on actual production are almost startling. Thus, in the southern part of California, as well as in western Arizona, crops may be started at whatever season suits the convenience of the grower, except two months in the year; and this holds true for market gardens as far north as San Francisco, where vegetables of nearly all kinds can be had in the market almost throughout the year. In Tulare and Kern counties five cuts of alfalfa have been taken off the same field in a single season and ten tons of its hay made; of sorghum, Egyptian corn, and pearl millet, when cut for forage, with irrigation, three heavy cuts per acre have been made—an enormous yield, which, of course, could be maintained only on a very strong soil, or, later, by the aid of manure. But irrigation enables the farmer to impart to the penny a nimbleness unheard of in regions dependent upon the seasons alone. The investment of a certain amount of money in land and manure can be "turned over" twice in the season, or even oftener in a region of long summers. There is no reason why the same could not be done in the southern states; but, as a matter of fact, it is done only where irrigation is compulsory.

The main irrigable area in the state is the great interior valley, embracing altogether about 30,000 square miles. Of this area about 11,300 square miles belong to the San Joaquin valley from the Cosumnes river to the Tejon mountains, a maximum length of 260 miles by from 30 to 70 miles in width. It is here, as well as in the southern region (Los Angeles, San Bernardino, and San Diego), that the irrigation question assumes the character of a vital problem, a *conditio sine qua non*. In the Sacramento valley irrigation is but little resorted to on the east side of the river, where, on the contrary, the mining *débris* problem agitates the public mind, and mining ditches furnish the supply of irrigation water chiefly to the foot-hill lands and mountain plateaus; while on the west side, in the counties of Yolo, Solano, and Colusa, irrigation is again prominent, though not so vital as in the San Joaquin valley, on account of the greater annual rainfall. Irrigation in the San Joaquin valley is thus far practically confined to that portion lying east of the trough and traversed by the rivers issuing from the Sierra Nevada. The total of the dry plain lands of this "east side" embraces an area of 7,687 square miles, of which about 69 per cent. may be assumed to be irrigable from the current water-supply of the streams. Since the trough of the valley lies much nearer the Coast range, in fact, touches the foot-hills at Buena Vista slough, in Kern county, the area of the "west side" is very much smaller, viz, about 2,689 square miles. As Mr. Hall says:

> All south of Tulare lake and a large portion north of the lake, on the west side, may be classed as non-irrigable land, not only on account of the absence of a sufficient water-supply, but by reason of the general unfituess of the soil for cultivation by irrigation. The sources of supply for irrigation are Tulare lake, the San Joaquin river, and the small streams of the Coast range.

According to the analysis of its waters, Tulare lake is altogether unfit, either as a source or even as a reservoir of irrigation waters, on account of its alkalinity, as stated more in detail further on. The small intermittent creeks flowing from the Coast range are but little to be relied upon in this connection, the more as the porosity of the

formations in that region renders storage very precarious. Supposing King's and the San Joaquin river to be the only available sources of supply, the irrigable lands of the west side would, according to Mr. Hall, be about 718 square miles, or 460,000 acres, making the grand total of lands irrigable from sources adjacent to the plain of the San Joaquin valley (exclusive of storage in higher reservoirs) about 6,000 square miles, or 3,840,000 acres. Of this vast area of highly productive soils only about 188,000 acres, or about 5 per cent., are estimated as being at present under irrigation.

Artesian water is to a limited extent already used for irrigation in the San Joaquin valley. In a few cases saline and alkaline waters have been obtained from the wells, but a considerable number have water that is no more objectionable than that of Kern river at least. Of late such wells, yielding abundant streams, have been obtained in Tulare county, in a region much troubled with alkali, which they will help to subdue. The possibilities of the valley in this respect have hardly yet been approximately ascertained, and it is very important they should be.

In the Sacramento valley the lands irrigated from Cache creek aggregate about 13,400 acres. There are no data for estimating the other irrigated lands of the plain, but the amount of irrigated land in the foot-hills of the Sierra (chiefly opposite the central portion of the great valley) may be taken at about 9,000 acres.

With the exception of Cache and Putah creeks, on the west side of the Sacramento valley, no important amount of irrigation water can be derived from the Coast range except through winter storage, which has not thus far been practiced. To the seaward of the Coast range small tracts of irrigated land are found from San Francisco southward, but they form the exception northward of Santa Barbara. In the Salinas valley it is not convenient, because of the small volume of the river and the lack of tributaries, and fair crops are made without it. Farther south it is more or less practiced in many of the seaward valleys, very generally so in the valley of Santa Barbara, and thence southward increasingly, until in the Los Angeles region the maximum proportion of irrigated lands is reached, the total in the counties of Los Angeles and San Bernardino reaching nearly 85,000 acres, and but little land being cultivable without it.

The amount of water available for irrigation can be very largely increased by winter storage in mountain reservoirs, storage in the hot lowlands, on account of evaporation, being wasteful. This, however, requires large capital and co-operative action, and will hardly be resorted to for some time to come, or until the water obtainable by the diversion of streams is exhausted.

The *practice of irrigation* by flooding is by far the most prevalent in California, but to a limited extent, in districts with sandy soils, lateral seepage from ditches is alone relied upon; and still more limited is the practice of sub-irrigation by means of cement pipe with outlets, which has come into use mainly for orchards and vineyards, especially where the supply of water is very limited, and can thus be made to do a much higher "duty" than by any other method. Its expense (ranging from $30 to $50 per acre) limits its application to crops of high value.

The duty of water under the ordinary systems varies greatly, not only according to the nature of the soil and underlying materials, but also with regard to the time that has elapsed since the beginning of irrigation in each district. This is especially apparent in the San Joaquin valley, whose porous soils are underlaid by sandy and gravelly beds easily permeable by water, and which in their natural state show no trace of moisture sometimes to the depth of 40 feet or more. At first all this dry mass requires to be saturated, and an enormous consumption of water occurs, amounting to many times the quantity that after a few years will be found amply sufficient to maintain vegetable growth. The water, of course, not only sinks vertically, but also drains sideways, and moisture is gradually found at lessening depths and at increasing distances from the ditch and irrigated land, thus benefiting parties altogether outside of the area intended. Again, irrigators are generally inclined to use water with unnecessary and even injurious liberality at first, until experience shows them that, especially in the case of fruit crops, a certain moderate allowance only insures the best result. "Over-irrigation" is the result of the natural instinct to supplement amply the deficiencies left by nature, but its disadvantages are coming to be more and more understood.

It is hardly possible to give an average of the duty of water in the irrigation districts of the state, but it may be broadly said that it varies from as little as 50 acres per second-foot in the newly colonized districts of the San Joaquin valley to over 500 acres in the colonies of the southern or Los Angeles region.

AGRICULTURAL REGIONS OF CALIFORNIA.—In most of the states embraced within the present series of reports the agricultural divisions are naturally based upon differences of soil and surface conformation arising from diversity of the underlying geological formations. In California the natural and generally recognized subdivisions are essentially dependent upon climatic differences, arising in the main from the topographical features, in which the several geological formations, as such, play only a subordinate part. From this point of view the several portions of the state may be conveniently considered under the following heads, transition zones of greater or less extent intervening, of course, between the several areas here defined:

1. *Region of the great valley*, with high summer temperature, intensely dry atmosphere, and no summer fogs. It is subdivided into:

A. The *Sacramento valley*, with from 20 to 40 inches rainfall; little irrigation needed. There is commonly a light snowfall in winter, the temperature falling as low as 26°, and frost temperatures at night for several months. The prevalent winds "up valley" are from somewhat west of south.

B. The *San Joaquin valley*, with from 4 to 16 inches of rainfall. Snow is rarely seen in the valley. The summer temperature is higher than in the Sacramento valley, but the nights are usually cool, especially in the upper part. Irrigation is needed for the safety of all field crops, and more or less for all others. The prevalent winds are "up valley", *i. e.*, from somewhat west of north.

2. *Foot-hill region of the Sierra Nevada and of the northern coast range* up to 2,500 feet elevation. The rainfall is greater than at corresponding points in the valley, increasing at the rate of one inch for from 100 to 150 feet ascent. The summer temperature is about the same as in the valley; the winters are somewhat colder, yet in sheltered locations frosts are very light.

3. *Semi-tropical or southern region.*—This region consists of the counties of Los Angeles, San Diego, and part of San Bernardino. The rainfall is from 13.6 to 9 inches, and irrigation is indispensable for almost all cultures. Frosts are rare, permitting the culture of semi-tropical fruits in the open air despite an occasional cutting-back in severe seasons. The prevailing summer winds are southwest, and fogs are rare.

4. *Arid plateau climate, or Southern desert region*, with from 8 to 4 inches rainfall and less; very variable, and some years almost none. This region embraces the Mojave and Colorado deserts, and is largely an irreclaimable sand and alkali desert, but has some fertile valleys, yielding well when irrigated, such as Owen's valley, Inyo county.

5. *The coast region*, having cool summers and warm winters, the ground rarely freezing, even superficially, save in the most northerly portions. Cool and moist westerly winds are predominant. This region is subdivided as follows:

A. *Region north of the bay country*, embracing—

(*a.*) Region near cape Mendocino and north of it, with from 32 to 80 inches of rainfall, northwesterly winds, occasional summer showers and thunder-storms, and snow often lying several days in the valleys. This is a transition to the Oregon climate.

(*b.*) Region south of cape Mendocino to the bay country, with from 20 to 32 inches of rainfall.

B. *Region of San Francisco bay* southward to Santa Cruz, with from 20 to 25 inches of rainfall and steady westerly summer winds and fogs; practically no summer showers, and no large-scale irrigation. Snow reaches the valleys only exceptionally, but light frosts occur for several weeks in winter as a rule.

C. *Region south of the bay country* from Monterey to Los Angeles, with from 9 to 16 inches of rainfall, and summer winds somewhat south of west, carrying fewer fogs than in the San Francisco region. Irrigation ordinarily is needed for field crops. Snow occurs only on the mountains, and frosts are rare.

6. *Mountain region of the Sierra Nevada and northern California.*—Summer and winter is well defined, and snow lies during several months in the higher regions to great depths, and with very severe cold. The rainfall ranges from 20 inches at the south to 100 inches at the north.

A. *Lava-bed region* of northeastern California, with from 20 to 22 inches of rainfall.

B. *Arid region* of the eastern slope of the Sierra.

C. *High Sierra*, a region of fir and pine forests and pasturage.

THE GREAT VALLEY OF CALIFORNIA.

The great valley of California, embracing a large proportion (one-third) of the agricultural lands of the state, is included between the foot-hills of the Sierra Nevada on the east and the Coast range on the west, the general direction of its axis being nearly northwest and southeast. Its length from the Tejon mountains, on the south, to Red Bluff, on the north, where the valley proper terminates, is about 400 miles, while its width varies from over 60 to somewhat less than 40 miles. Its total area is about 17,200 square miles.

Since the drainage is toward a point lying about three-fifths of its length from the southern end, where the San Joaquin and Sacramento rivers unite at the head of Suisun bay, the general slope of the surface is of course in that direction lengthwise. A cross-section will, in general, show the great drainage trough to lie westward of the axis (especially in the San Joaquin valley), with a gentle talus-like slope toward it from the foot-hills of the Sierra, while the Coast range mostly falls off rather abruptly into the valley, or into the trough itself. This is the natural result of the washing down of material from the long and elevated western slope of the Sierra, which also at present furnishes practically all the drainage slope from which the waters of the valley are derived, while the drainage from the Coast range is insignificant. These talus lands constitute an upland plain—for such it appears to the eye—into which the rivers emerging from the cañons of the foot-hills have cut valleys varying in depth from 40 to 140 feet at the eastern margin of the valley, but becoming shallower as the trough of the main rivers is approached. These lateral valleys are mostly quite narrow, varying from less than a quarter of a mile to (rarely) as much as one mile and more. They are usually timbered, and these timber belts form landmarks in the otherwise commonly treeless plain that are mostly visible from one tributary to another. In the San Joaquin division the lateral valleys are mostly bordered by abrupt bluffs; in the Sacramento valley rolling slopes come down to the bottoms proper.

In both valleys the main channel is, for a part of its course, bordered by fresh-water marshes, or "tule lands". From these the land rises gradually to the eastward to the level of the "plains", which on a large scale have a level or gently rolling surface, while on the small scale they are to a considerable extent dotted with the singular rounded

hillocks, popularly known as "hog-wallows", from 10 to 30 feet in diameter and from 1 to 2 feet high, which are evidently the result of erosion, but precisely under what conditions it is difficult to explain. These hillocks are usually most abundant near the foot-hills, with long scallops toward the valley, and the tracts seem to diminish in width toward the axial "trough", which they seldom reach, but they do not always bear any definite relation to the present streams. They occur on all kinds of soil, and even on the rolling foot-hill lands themselves, constituting an obstacle to easy cultivation that it is sometimes quite costly to remove; the more as their material is usually somewhat more compact than that of the intervening lower soil, and their leveling involves the baring of the subsoil. In some cases they are so thickly set, abrupt, and resistant as to render the land valueless for ordinary cultivation. They are almost always present on strongly alkaline soils, and one may often see them bearing good grain crops, while on the lower portions of the land the soil is whitened with alkali and the grain is dying. Oddly enough, in other cases, in consequence of differences in the capillary power of the soil in the two locations, precisely the reverse is seen. "Hog-wallow land" does not, therefore, imply any definite character of soil in general, although locally the character is often an exceedingly definite and distinct one.

The flood plains or tule lands of the streams are commonly bordered by more or less interrupted belts of land impregnated with an unusual amount of soluble salts or "alkali", which, during the dry season, bloom out on the surface and often interfere more or less with successful cultivation unless special precautions are taken to counteract their influence. Alkali is also sometimes found on the higher lands, especially in the San Joaquin valley, where the light rainfall is favorable to its accumulation. A discussion of this subject is given in the appendix to the regional descriptions.

The larger streams of the great valley have two periods of flood: one, caused directly by the winter rains, usually in the latter part of December and in January; the other, caused by the melting of the snows in the Sierra, affects only the rivers heading there, but is the most important from the irrigator's point of view, since it occurs at the time when water is most needed, in March and April, its duration and degree varying greatly in different seasons. The short streams heading in the foot-hills are, of course, only of limited importance to the irrigator so long as their water is not stored in winter.

The marsh or tule lands of both valleys will be considered jointly after the description of the higher lands.

THE SACRAMENTO VALLEY.

The length of the Sacramento valley from its extreme head, a few miles above Red Bluff, Tehama county, to the Calaveras river, in San Joaquin county, is about 160 miles. From a width of about 7 miles opposite Red Bluff the valley widens to about 15 miles near the Tehama line, 3 miles from the head, and then suddenly expands westward, assuming its average width of about 40 miles or a little over. Northwest of Woodland, Yolo county, it is narrowed, by a promontory of red foot-hill lands projecting into the plain from the Coast range, to about 33 miles, but below this rapidly widens again to its maximum width of 60 miles opposite Suisun bay. The area is about 6,200 square miles.

In the upper, narrow portion of the valley the streams enter at short intervals and squarely from either side, those from the Sierra especially emerging from deep, narrow, and rugged cañons cut into the lava-bed formation, and flowing for some miles in the belt of stony, treeless country at the foot before reaching the fertile alluvial plain of the river. The latter is quite narrow and distinctly defined from the red and usually more or less gravelly soil of the higher plain, which is treeless almost throughout, and is a heavy grain-growing region.

Southward, in Colusa and Butte counties, the foot-hills on either side are less abrupt, and a belt of undulating or rolling land of varying width, with red or yellow loam soils, borders the eastern side of the valley, sometimes merging gradually into the lands of the valley proper, and then again forming rather an abrupt terrace on the edge of the alluvial trough. Usually there intervenes between the latter and the red border lands a belt of adobe lands of varying width, which on the eastern side are mostly black (when wet), underlaid by a whitish calcareous hard-pan at a depth varying from 1 to 4 feet. In most cases these adobe lands are very productive and not very heavy in tillage. On the west side, in Colusa county, the adobe belt is even wider than on the east, but the soil is mostly of a gray tint, very refractory in tillage, and largely impregnated with alkali salts; hence the lands chiefly cultivated are those of the river trough (a fine silt soil of great productiveness), the tracts of partially alluvial soil deposited by the intermittent tributaries from the Coast range, and the red gravelly lands bordering the valley at its foot.

The drainage in this portion of the valley is of an exceptional character. On the west side the Coast range streams reach the great trough only in time of flood or of heavy rains, but during the greater part of the year they lose themselves about half way. On the east side the Sacramento receives no tributaries, the Sierra drainage being here received by Feather river, which emerges into the plain near Oroville, and thence for more than 50 miles in a direct line pursues an independent course in the valley, gradually converging toward the Sacramento river, with which it finally unites only about 18 miles from Sacramento city. The valley is thus on the east side divided between these two rivers, which are separated by a divide that rises rather abruptly from the trough of Feather river, then slopes off gently toward the Sacramento river, as does the plain on the east to the Feather itself from the base of the foot-hills.

The cause of this deflection of Feather river from its direct course to the central trough is manifestly the short but rugged volcanic mountain mass of the "Marysville Buttes", which here appears in mid-valley, forming a prominent landmark in the plain. The buttes, with their foot-hills, occupy an area of about 4 by 12 miles, and the bare, disrupted rocks and precipices of the central mass contrast oddly with the fertile plain around; the foot-hills, however, embrace some good grazing land. Immediately at their base the soil is gravelly, but soon shades off into heavy black adobe. On the south side this adobe tract is traversed by Butte slough, through which, in time of flood, a part of the waters of Feather river find an early outlet into the Sacramento.

Originally the soils of the immediate valleys of the Feather and Yuba rivers did not differ greatly from those of the Sacramento near and above Colusa. At the present time much of the valley lands of both streams has been overrun with the *débris* of the hydraulic mines, and their channels, to a great extent, meander in flood-plains formed by alternating deposits of coarse gravel, sand, and the finer deposit now too well and widely known under the designation of "slickens". The destruction of farming lands by this agency has already reached enormous proportions, and the filling up of the river beds by the continued influx of the overloaded waters causes these deposits to spread farther and farther every year, resulting in immense damage, not only from the flood itself, but also from the repeated deposits of the sediment, which, though an occasional dressing with it might be an improvement to the adobe soils of the central valley, is far from forming a desirable soil in itself. (*a*) The evil affects, of course, not only all the country adjacent to the Feather, Yuba, and their tributaries, but also the entire valley below the junction with the Sacramento. Hence, with a comparatively abundant rainfall and only a limited need for irrigation, the prominent topic in the Feather and lower Sacramento valley is the "*débris* question", the final adjustment of which between the conflicting interests of the farmers and those of the hydraulic miners has hardly yet approached the phase of a definite common basis. The peaceful town of Marysville, once known as "the city of the plains", now frowns upon the visitor from behind levees of such height and massive strength that he instinctively looks for the cannon that is to defend a beleaguered city. Yet, even as they are, these levees need the constant watchfulness of the inhabitants and an annual heightening and strengthening against the annually increasing floods. Outside the walls, where there was once a fertile bottom, traversed by a quick and clear stream, stretches a sandy and gravelly waste, through which the waters of the Yuba meander in sluggish and dirty loneliness. Nothing can be more eloquent of the pressing need of a final disposal of this evil, the magnitude of which can hardly be realized by those who have not seen with their own eyes.

Below the Yuba again, and down to the American river, but few of the foot-hill streams reach the main Feather river, save in flood time. Their waters are partially utilized for irrigation near the foot-hills, but, on the whole, the grain crops for which this region is noted succeed well without its aid. An analysis of the loam soil of the neighborhood of Wheatland, Yuba county, from the rolling upland belt, in which the valleys of the streams are but slightly sunk, is given on page 22.

A broad tract of alluvial land, of high productiveness but liable to overflow, lies in the fork of the Sacramento and the American rivers; it is largely protected by levees along the banks of the rivers.

Southward of the American river, and across the Cosumnes and the Mokelumne to the Calaveras river, extends a plain, broken only by occasional swales of reddish soil running in from the foot-hills. This is one of the most productive and thickly-settled portions of the entire valley, the soil being mostly a dun-colored loam, varying in its lightness, but throughout easily tilled. Besides grain, which occupies the greatest breadth of land, vineyards and orchards are conspicuous in its landscape, which is here and there dotted with oaks, while the horizon is bounded by the timber belts along the water-courses. Irrigation increases as we advance southward, but is not usually applied to the larger field cultures, although this might beneficially be done to the full extent of the capacity of its streams, as it will undoubtedly be whenever the now predominant grain production shall be superseded by a more varied system of culture. The direct distance from the foot-hills to the mouth of the Mokelumne is about 38 miles, and for the greater portion of this distance its valley is so depressed below the general level of the plain that, for irrigation purposes, its waters must be tapped within the foot-hills. The distance between bluffs is from one-half mile to one mile, and the channel is bordered by rich alluvial bottom lands lying above ordinary floods. A short distance below Woodbridge the river enters the great tule region.

Opposite the region just considered, across the broad tule belt encompassing the junction of the two rivers, lie the rich alluvial plains of Yolo and Solano counties, the soils of which are of pre-eminent fertility, being a mixture of the finest natural sediments of the Sacramento river with those carried by the streams heading in the volcanic portion of the Coast range (of which Cache and Putah creeks are the chief), experience in this respect being confirmed by the analysis given further on (see 110 in table). The plain is scarcely broken by the slight undulations or swales coming down from the foot-hills; but the region is thickly settled, and is largely occupied by orchards and vineyards.

a See analyses on page 22.

Irrigation is not general, chiefly on account of the limited water supply, which is dependent mainly upon the limited volume carried by Cache and Putah creeks, but partly and increasingly upon shallow wells sunk into the water-bearing gravel which underlies the region. This fact and the great depth of soil renders grain crops measurably independent of irrigation.

Cache and Putah creeks, not being supplied by winter snows or forest-clad ranges, are intermittent streams, carrying in the winter season formidable floods, which then partly find their way across the country to the trough of the Sacramento, while they become insignificant during the dry season, or even between the rains which drain rapidly from the steep slopes of the Coast range.

Nearly one-half of the drainage of Cache creek is received into Clear lake, which thus to some extent serves as a regulator of its flow. From the lake the creek passes through a cañon about 30 miles in length, receiving two large tributaries from the north before it enters the head of Capay valley. The latter is about 18 miles long and 1 or 2 miles wide, and has a considerable area of irrigable though somewhat heavy land.

On entering upon the Sacramento plains the creek widens out into a channel from 500 to 1,000 feet in width with low banks and decreased grade, and before reaching the town of Cacheville is confined between vertical banks from 20 to 25 feet high and from 100 to 150 feet apart, which condition it maintains for several miles; but on approaching the lowland of the Yolo basin the banks drop away, and the stream is free to spread out in a broad delta, seeking the lowest part of the basin, and emptying into the Sacramento river through Cache slough.

Soils of the Sacramento valley.

The soils of the Sacramento valley are as yet but very inadequately represented by the subjoined analyses, the material on hand being too limited to allow of selecting representative samples advisedly. Nos. 563 and 110 are probably of wide applicability, and Nos. 517 and 561, taken together, may also probably be taken as fairly representative of the loam of the east side of the valley. Of the true "adobe" of the valley no analyses have thus far been made.

No. 563. *Sediment soil* from near the banks of the Sacramento river, on the Rancho Chico, General Bidwell's land, Butte county. A gray or dun powdery loam, with but little coarse sand, very easily tilled, and the same to a depth of several feet; is well timbered with white oak (*Q. lobata*), ash, and sycamore, with abundance of grape-vines, and is very productive in cultivation. Depth taken, 12 inches.

No. 561. *Dark "adobe" loam soil* from the Rancho Chico, about a mile east from the spot where No. 563 was taken. Dark tinted and moderately heavy, so that after drying it can still be crushed between the fingers; taken to the depth of 12 inches, becoming paler colored below that depth; originally treeless, bearing a growth of sunflowers and alfilerilla. This soil is not as regularly or as highly productive as the river land.

No. 517. *Reddish soil* from near Bigg's Station, Butte county, a clay loam, brownish dun in color when dry and brownish black when wet. The dry lumps are hard to crush between the fingers, but soften quickly on contact with water. This soil occupies a level belt, lightly timbered with oaks, to the eastward of the adobe belt of this region. Between the two there usually intervenes a streak of whitish soil, from which there is a gradual transition to the true adobe. Depth taken, 12 inches.

No. 656. "*Slickens*," or fine mining *débris* deposit, from Yuba river, Yuba county, sent by the secretary of the "*débris* committee" of the city of San Francisco. Light yellowish gray, partly in powder, partly in chalky lumps, easily crushed, very light, and scarcely palpable, emitting a strong clay odor when breathed upon or when wet.

No. 1004. "*Slickens*" *sediment* from Alger's bend, Feather river, Butte county, furnished by Mr. Julian Le Conte, of the United States river and harbor survey. A compact, yellowish-brown lump, somewhat heavier than No. 556, which can be crushed between the fingers with little difficulty to an altogether impalpable powder, and emits a strong clay odor when breathed upon or dampened. The deposit is stated to have been from 6 to 8 feet in thickness in the bed of the river, which upon drying forms wide gaping sun-cracks, allowing a man to walk between the blocks on a base of sand. When deposited it must have been almost in a gelatinous condition.

No. 10. *Sediment soil* from the farm of Mr. Daniel Flint, on the Sacramento river, a few miles below Sacramento city, Sacramento county, deposited during high water, and said to exert a remarkable effect in increasing the productiveness of the land, especially clay land, upon which it may be brought. It is a light, buff-colored silt, almost impalpable when rubbed between the fingers, and without sand or gravel. Depth taken, 12 inches.

No. 110. *Soil of Putah valley*, near Dixon, Solano county, sent by J. M. Dudley, from the "middle land" of the plain, on the slopes of the swales, about 3 feet above the lowest land. Depth taken, 12 inches.

No. 499. *Red upland loam soil* from near Wheatland, Yuba county. A stiffish, glaringly orange-red loam, forming the soil of the undulating uplands stretching from the foot-hills several miles into the valley, and but little above the general level of the latter; it tills easily when taken in the right moisture condition, but plows very cloddy when either too wet or too dry. This soil is chiefly given to pasture and wheat growing, and yields from fifteen to twenty and sometimes twenty-five bushels of fall or winter-sown grain in good years, and in poor ones from eleven to thirteen bushels per acre, but never altogether fails. It responds very kindly to summer fallowing, and in its natural condition has almost only herbaceous vegetation, with some scattered poison-oak bushes.

Soils of the Sacramento valley region.

	BUTTE COUNTY.			YUBA COUNTY.	BUTTE COUNTY.	SACRAMENTO COUNTY.	SOLANO COUNTY.	YUBA COUNTY.
	Sacramento river alluvium, Rancho Chico, S. 27, T. 22, R. 1 W.	Black-loam soil, Rancho Chico.	Brownish-loam soil, Bigg's Station.	"Slickens" from Yuba river.	"Slickens" sediment, Alger's bend, Feather river.	Sediment soil, Sacramento river.	Putah valley soil, middle land.	Red-loam soil, Wheatland.*
	No. 563.	No. 561.	No. 517.	No. 656.	No. 1004.	No. 10.	No. 110.	No. 499.
Insoluble matter	70.764	59.144	63.268	72.169	61.029	55.283	67.334	78.789
Soluble silica	2.680 } 73.444	3.160 } 62.304	4.750 } 68.018	3.071 } 75.240	8.033 } 69.062	13.940 } 69.223	3.671 } 71.005	3.803 } 82.592
Potash	0.652	0.305	0.458	0.267	0.300	0.353	0.929	0.249
Soda	0.077	0.221	0.113	0.025	0.124	0.065	0.124	0.035
Lime	1.444	2.909	1.460	0.794	0.521	0.901	0.770	1.021
Magnesia	2.277	1.042	2.174	0.866	0.768	1.249	2.285	0.471
Brown oxide of manganese	0.015	0.025	0.105	0.025	0.089	0.111	0.106	0.018
Peroxide of iron	5.804	9.342	8.585	6.582	6.586	6.316	8.011	5.811
Alumina	10.397	13.038	12.045	10.390	14.229	15.251	9.159	6.283
Phosphoric acid	0.087	0.095	0.064	0.076	0.078	0.250	0.111	0.043
Sulphuric acid	0.030	0.063	0.047	0.134	0.067	0.097	0.120	0.019
Water and organic matter	5.351	10.149	6.701	5.716	8.024	6.751	7.115	3.644
Total	99.578	99.498	99.765	100.115	99.848	100.567	99.735	100.186
Humus	0.749	.....	1.184	.....	.....	.....	1.709	0.466
Available inorganic	0.255	.....	0.464	.....	.....	.....	0.562	0.336
Hygroscopic moisture	6.84	13.980	8.29	.....	10.09	.....	10.315	4.81
absorbed at	11.5 C.°	13 C.°	13 C.°	.....	15 C.°	.....	15 C.°	.....

* No. 499 is properly a foot-hills soil, lying in the edge of the plain, and is introduced here for comparison with the valley soils proper.

The common characteristic of all these soils is an adequate and, in some cases, a generous supply of lime, which insures the availability of the plant-food they contain, greatly enhances their power of resisting drought and of forming and retaining humus, and renders them easily tillable, notwithstanding the large amount of clay they contain. This feature, as will be seen hereafter, characterizes to a greater or less extent most of the soils of the great valley from Redding to Bakersfield, and it is with constant reference to it that their agricultural qualities must be considered.

Passing to the other primarily important ingredients of plant-food, we find that in the alluvial soils proper—as in that from Dixon and from the Sacramento near Chico—the amount of potash is large, in the former case even very large. Away from the river this ingredient diminishes in the case of the Rancho Chico to one-half of what it was near the river, the deficiency being partly offset by a very large supply of lime in No. 561, which manifests itself in its dark tint. In the soil from Bigg's Station, the tint of which indicates a partial derivation from the red materials of the foot-hills, the potash supply is more ample.

In none of these soils, however, is the supply of phosphates a large one. In that from Bigg's Station, but for the presence of a liberal amount of lime, it would be accounted deficient. Whenever their production shall have been materially diminished by exhaustive cultivation the use of phosphate fertilizers will evidently be the first thing needful to restore productiveness.

Nos. 656 and 1004 may be considered as fairly representative of the composition of the finest material, or "slickens", brought down from the hydraulic mines by the Feather and the Yuba rivers and deposited in their back or slack waters. A comparison of their composition with that of the above soils shows that they do not differ very widely in their mineral ingredients, as might be foreseen from the community of their origin. Their potash percentage is low, yet not lower than that of some good soils. The lime percentage, while lower than in the Sacramento alluvium, is reasonably high, and the supply of phosphoric acid, while not large, is only a little below the average of the soils analyzed. It may be expected, therefore, that whenever these "slickens" soils shall have been subjected for an adequate length of time to the same agencies that have been active in the natural alluvial soils they may become equally productive. As they are, however, they lack a high essential of all agriculturally valuable soils, viz, the humus or vegetable mold, whose physical as well as chemical action is so important to the welfare of plants that popular belief has long ascribed to it a controlling influence on fertility; and although we now know that humus is but one of the many factors that contribute to the productiveness of soils, we also know that, practically, its deficiency or its absence is an effectual bar to profitable culture. Under the climatic conditions of the Sacramento valley it will take many years to remove this disability in the natural course of things. The process may be hastened by the operation of green-manuring, provided green crops can be grown on the material; and this will, in general, be the most important step toward the reclamation of tracts covered by "slickens".

It is hardly necessary to advert to the fact that the material of the *débris* brought down from different channels and at different times may vary indefinitely, from cobble-stones, through gravel and sand, to the finest

matter, graphically designated as "slickens", and, according to the sources from which the latter come, the chemical composition will also vary locally. Moreover, when a coat of moderately sandy material is deposited on adobe land, the intermixture of the two by the plow may oftentimes result in a material improvement in consequence of the removal of the extreme mechanical intractableness of the clay land. In other cases a local deposit may be exceptionally rich in some important ingredient, and may thus serve directly as a fertilizer when applied to cultivated land. Analysis No. 10 shows a case in point, in which a deposit on the banks of the Sacramento river is so rich in phosphoric acid as to be available as a fertilizer on the adjacent alluvial lands. Some of the effects observed may also, it is true, be due to the improvement of the mechanical condition.

It cannot, therefore, be surprising that the testimony as to the local effects of "slickens" on land overrun by it should vary considerably, according to the circumstances of the case. Cobble-stones and gravel will in every case be considered an unmitigated detriment. A moderate coat of sand spread on an adobe tract may be welcomed at first, but its repetition will naturally be objected to, and a deposit of any considerable thickness will effectually spoil the land forever. So also a moderate coat of "slickens" will, on the low and heavy lands on which it is most widely deposited, be at first a benefit, as it will improve the tilling qualities of the land, and, finding a sufficiency of humus in the soil, its fineness will cause it to be promptly acted upon and utilized as a source of plant-food. But whenever the deposit is repeated, the advantage diminishes, and finally changes to a very positive detriment so soon as the "slickens" becomes the predominant ingredient of the cultivated soil, while a thick deposit coming at once will, for the time being, and usually for many years to come, deprive the farmer of the profitable use of his land, albeit it may become profitable to his children or his grandchildren.

Such I consider to be the impartial view of the "slickens" question, independently of the obstruction of channels and consequent overflows, the consideration of which lies outside of the province of this report.

THE SAN JOAQUIN VALLEY.

The division of the great valley traversed by the San Joaquin and its tributaries constitutes about three-fifths of the whole, its area from the southern end to the Calaveras river, a distance of about 240 miles, being about 11,000 square miles. Its prominent topographical feature, as against the Sacramento valley, is the lake basin formed in its southern half by a low water-divide which traverses the valley in the southern part of Fresno county, by which the waters of King's river are thrown southward into Tulare lake. Northward of this divide the San Joaquin river enters the valley, and, traversing it, turns northward on reaching the trough, receiving thereafter directly the entire drainage of the Sierra. The valley is thus subdivided into the southern or *Tulare basin* and the *San Joaquin basin* proper.

At present this cross ridge is intersected near its western end by Cole slough and other channels, through which the surplus waters of Tulare lake or King's river can find their way into the San Joaquin. Previous to the formation of this outlet the entire upper valley was evidently for some time a shallow lake, of which Kern, Buena Vista, and Tulare lakes, with their bordering tule swamps, are the remnants. The main tributaries of this basin, heading in the Sierra itself, are the Kern, Kaweah, and King's rivers, which carry running water throughout the year. Besides these there are numerous water-courses, of more or less intermittent character, heading in the foot-hills and reaching the main trough only in time of flood or not at all, such as Posey, White, Tule, and Deer creeks, which can therefore be relied on for irrigation to a limited extent only. These water-courses are bordered by moist lands, which do not require as much water as the higher plains.

The streams of the Tulare basin enter the valley from the Sierra cañons in remarkably shallow channels, but then cut deeper ways into the plains proper, again approaching the general surface as they near the trough, which lies about two-thirds of the way to the Coast range. The streams descending from the latter are of the most intermittent character, the slopes of the range being steep and bare of forest; so that the land drains the more rapidly, as it is mostly very sandy. Hence the Coast range streams mostly lose themselves before reaching the trough, and are in any case available for irrigation only locally and to a limited extent unless stored. This character of the Coast range drainage is also the same northward in the San Joaquin basin. The streams flowing from the Sierra, on the contrary, there lie in deeply-cut channels for many miles out from the mountains, and do not approach the level of the plain until shortly before reaching the trough, when they turn northward.

The Tulare basin.

The Tulare basin is terminated on the south by the amphitheater of the Tejon and Tehachapi mountains, which rise from the valley with rather a gentle slope of good grazing lands, but are destitute of timber, as seen from the valley. Conforming in shape to that of the base of the mountains, but separated from the latter by a slightly sloping plain from 8 to 10 miles wide, lies the V-shaped trough of lowland in which Kern and Buena Vista lakes form sheets of water, at present rapidly decreasing, disconnected from one another by the lowering of the water-level by evaporation. From the same cause these waters are very sensibly alkaline, and, of course, increasingly so as the evaporation progresses, the same characteristic being imparted to the shore-lands left by the receding

waters. At the western end of the trough, Buena Vista slough connects (or connected) the lake of that name with the southern end of Tulare lake. This slough at one point touches the base of a projecting spur of the Coast range, but below or northward of that point it is bordered by a broad belt of tule lands to the head of Tulare lake. Within the angle of the V mentioned lies what is known as Kern island, being mainly the delta of Kern river included between its ancient and modern channels, the former of which led directly into Kern lake, while the latter strikes Buena Vista slough.

Kern river, after leaving its precipitous cañon, flows mostly between gravelly bluffs of 100 or 200 feet high before reaching the valley proper. At this point it has been wont to spread in divers channels, seeking an outlet into the lakes, the distance from its present outlet to the mouth of the cañon being about 40 miles. From about 5 miles below the latter its bed is composed of shifting quicksands, varying in width from 150 to 800 feet. The banks are low, sandy, and unstable, and the land slopes rapidly away from them, offering great facilities for irrigation. Hence there is no other river in the state from which so many canals and ditches have been made to divert the water, their excessive multiplication giving rise to great waste of water. The higher lands bordering the eastern foot-hills, as well as the higher parts of the plains lands farther out in the valley, have not as yet been irrigated.

Details in regard to the alkaline character of some of these lands are given in the discussion following the regional descriptions. As a whole, they are highly productive, and have proved especially well adapted to the cultivation of cotton, though at present they are chiefly devoted to the culture of cereals and alfalfa.

The lands lying westward of Buena Vista slough and Tulare lake are reported to be very sandy, and few attempts at cultivation have as yet been made. Northward from the region irrigated from Kern river the sandy loam soils of the plains are but little cultivated as yet, but locally the foot-hill streams are utilized, and Tule river especially serves to irrigate a small but fertile district.

The *Kaweah river*, like the Kern, forms its delta far in advance of it, without reaching the great drainage trough, to which, indeed, it has not at present any definite channel. It begins to spread immediately after leaving its rocky cañon within the foot-hills, and loses a considerable portion of its waters in the beds of sand, gravel, and light alluvium with which it has built up the plain for many square miles in front of its point of emergence from the mountains. From the cañon to Tulare lake this river is 39 miles in length, falling, in that distance, from an elevation of 520 feet to that of the lake, viz, 190 feet above tide-water. In the upper portion of its course the grade is at times as much as 30 feet per mile, alternated with comparatively flat and swampy tracts, heavily overgrown with oaks and underbrush; but near the lake the plain falls only 2 or 3 feet per mile, and, without irrigation, is dry and barren. Down this sloping delta plain the Kaweah flood-waters find their way through eight or ten channels, whose beds are upon deep beds of sand, and are occasionally lost altogether in some swampy tract, the waters partially emerging below into another channel under another name. About half-way down the plain, from Cross creek on the extreme northwest to Outside creek on the southeast, the width of the delta is about 18 miles; but these channels approach each other lower down and enter the lake only 10 miles apart.

This, the Visalia region of Tulare county, is to a large extent heavily timbered with white oak (*Q. lobata*), and is the one wooded district of the San Joaquin valley; for elsewhere a few oaks, scattered widely apart, are all that is usually seen, and these are away from the main channels of the streams. The soils of the region vary considerably, from that of the sandy plains to a rich alluvial deposit, most of which contains some alkali, especially near the streams, but not usually enough to interfere with successful cultivation. From the numerous creeks irrigating ditches traverse the delta plain in every direction, leaving but little water unused, save in times of flood.

A belt of very strongly alkaline land about 2 miles wide borders the Visalia district on the west and northwest, but the impregnation becomes less as King's river is approached.

King's river, both from its location with reference to the adjoining country and from the volume and purity of its water, is one of the most important irrigation rivers of the state. Where it leaves the foot-hills all the water flows in a single channel, but in its passage through the adjacent "Centerville bottoms" its waters divide into several channels for a distance of 14 miles, and then again unite and remain confined to a single deep and tortuous channel the bed of which is from 20 to 65 feet below the surface of the adjacent plains. Practically, this portion of the river has no valley or bottom lands, the high bluffs encroaching generally upon the margin of the river. Here and there the bluffs recede, and the river is fringed with a narrow belt of alluvial land, covered with a scanty growth of oaks and vines. This condition is maintained to the head of Cole slough, where its waters are again divided, the greater part passing northward through the slough, and the rest along the old river channels, spreading into a delta-like swamp between Tulare lake and the San Joaquin river. King's river has not a single perennial tributary from the foot-hills to Tulare lake, a distance of about 62 miles.

South of King's river, and included between it and the tule lands bordering Tulare lake, lies the Mussel Slough country, so noted for its fertility, and which is irrigated by many ditches from the river, aggregating about 120 miles in 1880. The soil of the Mussel Slough country is mainly a light alluvial loam of great depth, evidently quite distinct from the soils of the higher plains. North of King's river its waters, taken from near its point of exit from the mountains, pass through numerous ditches (aggregating about 120 miles) to the plains of Fresno, lying considerably higher than the Mussel Slough country and possessing a very different soil—largely a whitish and very calcareous silt, quite unlike the plains soil of Tulare and Kern, but also yielding abundant returns when

irrigated. The Fresno plains are gently rolling, almost exempt from alkali, and in spring present the appearance of a carpet of flowers. Near the foot-hills the red-clay soil of the latter has been mingled by the streams with the sand of the plains, making what is there called "red adobe". None of these streams cross the railroad, the plains to the westward being without any permanent channels and falling off gently into the long belt of "tules" that stretches between Tulare lake and the turn of the San Joaquin river.

The San Joaquin basin.

The *San Joaquin river*, on emerging from its cañon in the foot-hills, continues into the valley in a channel much depressed below the surface of the plains, and hence is, of all the rivers of the valley, the most difficult to draw upon for irrigation. For from 16 to 18 miles below the mouth of the cañon its water surface lies from 75 to 200 feet below the rolling plains, which frequently fall off to it in perpendicular bluffs. Hence, although the land to the southward is fertile and irrigates well, but little has been done in that direction. North of the river the foot-hills extend far down into the valley, and have a hard-pan subsoil, which sometimes lies almost bare and would not irrigate well. About midway to the trough, however, the soils are lighter and better suited to farming, and the river is more easily approached from either side, the plains being only 35 or 50 feet above the bed. To the southward the soils are mostly deep and rather sandy; but northward they are heavier, and their irrigation (water taken from the Chowchilla canal) requires great skill to prevent injury from excessive flooding, and are largely underlaid by a sandy and wholly impervious hard-pan. On the west side of the river the lands irrigated by the San Joaquin and King's River canal are very variable. For 35 miles from the great bend the land below it is for several miles a black, alkaline adobe, underlaid by a not wholly impervious, marly hard-pan, difficult to irrigate and till; but between Firebaugh's and Hill's ferries there are along the river large areas of sandy alluvial loam, readily irrigated and quite productive.

The *Fresno river*, or rather creek, about 12 miles north of the San Joaquin, is an intermittent stream, and about half-way to the trough is bordered by rough and rolling lands with an inferior soil. Below it passes through level land with a rich, sandy loam soil, and supplies a canal on the south side.

The *Chowchilla*, *Mariposa*, and *Bear* creeks, entering the plain from the foot-hills between the Fresno and Merced rivers, are intermittent streams, and flood the plain after heavy storms through numerous small channels, from which some of the water finds its way into the trough, while most of it is absorbed in the pervious soils of the region bordering the latter. Around and south of Merced city, between Deadman's and Bear creeks, there is a considerable body of black adobe lands, of which a narrow strip about 2 miles wide continues northwestward through Stanislaus county into San Joaquin, where this kind of soil is more characteristically developed.

Northward of Merced city a wide tract of "hog-wallows" comes in from the foot-hills, and is an excellent wheat soil in its level portions; but midway to the Merced river this tract rises into a foot-hills ridge, with a gravelly clay soil, that extends far out into the valley, and is of inferior quality. Toward the Merced river the soil again becomes lighter and productive, and is irrigated by a canal from the river.

The *Merced river* heads among the highest ranges of the Sierra, and, after traversing the Yosemite valley, passes to the edge of the plain through a deep, rocky cañon with a water-fall at its outlet. Thence its valley runs to the trough in nearly a straight line southwestward for 36 miles, but within it the river winds on a very tortuous course between abrupt bluffs as much as 3 miles apart and from 40 to 80 feet in height 8 miles below the falls, and thence narrows down within the next 8 miles to about 1 mile from bluff to bluff. These bluffs become still more contracted and less sharply defined as they approach the level of the plains on nearing the trough of the San Joaquin.

The wide lozenge-shaped bottom, terminating 16 miles below the cañon, is an important agricultural region, and is of especial interest in having been the sole locality of cotton-planting in the state for a number of years. The soil is a dark, sandy loam of great productiveness when supplied with moisture. At times of flood the water spreads from the main channels over the valley, frequently shifting its course permanently, cutting away large soil areas and covering them with coarse gravel. The soil is almost everywhere underlaid by such gravel at varying depths, sometimes coming close to the surface. Some levees have been constructed to prevent overflow and shifting, and it thus becomes necessary to irrigate the lands so protected. All the cotton grown here has, therefore, had the aid of irrigation.

The country between the Merced and the Tuolumne rivers is quite rolling near the foot-hills, the soil being generally sandy, resembling somewhat that of the Tulare plains, but on the whole less productive; on the other hand, the rainfall being greater, much grain is grown here without irrigation.

The *Tuolumne river* comes from the mountains through a most forbidding cañon, below which it is closely flanked by foot-hills, merging into rolling lands, and then into a plain lying from 50 to 80 feet above its water surface for 20 miles below the cañon. Thence the plain falls off toward the trough of the valley, so that the banks are only from 15 to 25 feet in height. For 30 out of the 42 miles of the river's course it is bordered by plains sufficiently even in surface to admit of irrigation on the large scale to advantage, having soils particularly adapted to its practice; and since in its habitual water volume the Tuolumne stands first among the rivers of the San Joaquin valley, its importance as a source of irrigation is very great, although thus far it has been but little utilized, the reason being that its bottom lands are very limited, and costly works are required to bring the water upon the high plains.

Between the Tuolumne and the Stanislaus the soil gradually changes from its very sandy character near the former river to a dark and more substantial loam of high productiveness.

On leaving the foot-hills, the *Stanislaus river* lies in a deep and generally narrow trough from 100 to 150 feet below the plains, its bottom being very narrow, rarely exceeding a few hundred yards, but having an excellent soil. In its lower course its slope is much less than that of the adjacent plains, so that within 10 miles of its mouth it lies but 40 or 50 feet below the plains level. Its immediate channel here is so narrow as to be altogether inadequate to carry the flood discharge, and hence the bottom is periodically overflowed. The soil of the plains adjacent to the Stanislaus is excellently adapted to irrigation, but the great depth of the river channel below the surface renders it necessary to locate the heads of irrigating ditches some distance up the cañon, and this is a costly undertaking. Hence irrigation is practiced on but a limited scale thus far; but in the deep, light loams a large amount of grain is grown without irrigation, and with comparatively few failures.

North of the Stanislaus to French Camp slough the land continues sandy, and is largely unproductive without irrigation. North of the slough, to and beyond the Calaveras river, lies the region of black adobe lands that constitute one of the most productive and densely-settled portions of the valley. Its surface is gently undulating, and is sparsely dotted with oaks. On the border of the tules, as well as at some other points, there are more or less interrupted belts of alkali land, mostly with a "hog-wallow" surface. The soil does not appear to differ materially from that of the adjacent lands, and by proper treatment it can doubtless be brought under profitable cultivation. (*a*)

The *Calaveras river* does not head high enough in the mountains to be perennial in its flow, the direct distance being about 25 miles from its point of emergence from the foot-hills to its junction with the San Joaquin river. At Bellota the stream forks, one channel, Mormon slough, passing westward through Stockton, the other, diverging to the northward, entering the San Joaquin about 5 miles northwest of Stockton.

Mormon slough is now the principal channel, and carries water when the northern branch is dry. In extreme floods both these channels are incapable of carrying the volume of water, and at such times the plains are extensively overflowed from the numerous side streams that put out from the main channels at weak points in their banks.

Before reaching the valley the water of the Calaveras is repeatedly used for mining purposes, and is always highly charged with fine sand and sediment; hence it is considered especially valuable when used in the irrigation of the heavier soils, the sandy sediment rendering the adobe more mellow and tractable.

Soils of the San Joaquin Valley.

As stated, the soils of the southern part of the great valley, even to the alluvial ones, are predominantly sandy, except in the main trough of the San Joaquin river; the sand being in most cases coarse. Exceptional in these respects are the fine silt soils of Fresno and the black adobe of southeastern Merced.

In the descriptions and tables given below the soils are segregated into upland or plains and lowland soils for convenience of consideration, but it must be admitted that the distinction is, of necessity, often somewhat arbitrary. Again, the two first mentioned (adobe soil and subsoil from Stockton) are much more closely related to the soils of Sacramento valley than to those of the San Joaquin, the characteristic sandy soils beginning some miles to the southward of the city of Stockton. True black adobe is, nevertheless, found again near and eastward of Merced city.

A.—Alluvial or lowland soils.

No. 6. *Black adobe soil* from S. 45, Weber grant, near Stockton, now the property of D. A. Learned, of San Joaquin county. This soil is dark-colored, very adhesive when wet, but in drying it cracks open at times to the depth of several feet. The sample was taken to the depth of 12 inches, the soil remaining the same. Its thickness varies from 6 inches to 4 feet, the latter coming nearest its average depth. The main body of this land lies between French Camp slough on the south and the Calaveras river on the north, extending 2 miles beyond the latter; westward it reaches to the alkali lands bordering the tules, while its eastward limit is not well defined, but lies at least 10 miles to the eastward of Stockton. The wheat product of this soil, when fresh, averages between 15 and 20 bushels per acre for five to eight years, and then decreases, but can be brought up by summer fallow and good cultivation.

No. 7. *Hard-pan subsoil* of No. 6, found underlying the black adobe in the lower ground at varying depths and of varying thickness, from 6 inches to several feet. This is a yellowish or whitish-gray, moderately coherent mass, more or less porous, which effervesces with acids, leaving a loose mass of sand and silt.

No. 195. *Valley soil* from a valley 2 miles south of the Merced river, Merced county, on the Hopeton and Merced road, through which the Farmers' ditch passes. This soil is a blackish-brown loam, easily tilled, and fairly representative of the soils of the smaller valleys of this as well as of the Dry Creek region.

No. 198. *Bottom soil of Merced river* from J. A. Grade's cotton plantation, near Hopeton, Merced county; a dark-colored, light loam soil, varying in depth from 18 inches to 5 feet, according to location, usually underlaid by gravel, which undulates more or less in subterranean ridges. Its chief natural growth is the California sunflower, which grows very luxuriantly, with some oaks and cottonwood on the lower ground. The bottom here is about 4 miles

a See article on alkali soils on page 63 for some details regarding this region and the general subject.

wide from bluff to bluff, and is traversed by numerous sloughs, as well as by gravel ridges. This soil in good seasons has made over 1,200 pounds of seed-cotton per acre, and a large body of it constitutes the Strong, Grade, and Buckley ranches, where cotton has been successfully grown for many years.

No. 570. *"Brown adobe" soil* from the lower land in the Eisen vineyard, near Fresno, Fresno county, taken to the depth of 12 inches; reddish brown, only moderately heavy, with much coarse sand intermixed, and easily tilled, except when very wet. This soil may be considered representative of the more substantial soils formed by the foot-hill creeks between King's and San Joaquin rivers in the shallow valleys, separated by divides of "sand-hill" ridges with very sandy soils.

No. 701. *"Dry bog" soil* from a valley on Sisson, Wallace & Co.'s land, 6 miles northeast from Visalia, Tulare county, in the "hog-wallow" hills; a black, heavy soil, occurring in the smaller valleys among the "hog-wallow" land. This soil is chiefly covered with long grass during the growing season, and, like the "adobe" elsewhere, is often deeply fissured during the dry season. It has usually at a depth varying from 6 to 18 inches a subsoil of heavy gray clay, with spots and concretions of bog ore, or "black gravel"; hence it is commonly ill-drained and needs drainage first of all. But little of it is cultivated. The analysis was made to determine its value for permanent culture when reclaimed.

No. 585. *"Wire-grass soil"* from wooded flats 2 miles west of Visalia, Tulare county. The soil is a gray or blackish, moderately heavy loam, characterized by a growth of wire-grass (*Scirpus*) and more or less of alkali grass (*Brizopyrum*), with alfilerilla. It is well timbered with oak. In low places occasionally a little alkali is visible on the surface, but there is not enough of it in the land to prevent the growing of cereals or other crops, and it is highly productive.

No. 579. *Alluvial loam soil* from near Grangeville, in the Mussel Slough country, Tulare county, and fairly representative of the best class of soils, yielding 46 bushels of wheat per acre. The soil is quite light and easily tilled, with no change of color for from 18 to 24 inches. Sample taken to the depth of 12 inches.

No. 77. *"Dry bog" soil* from the banks of Tulare lake, near its southeast corner, from overflowed land reclaimed by E. R. Thomason. This tract is inclosed by a levee, and lies below the high-water mark of the lake. Eighteen months previous it was all under water, but at the time of taking the sample the water was half a mile from the levee. The first vegetation that started after it was laid dry was "wild parsley", followed later by wire-grass, salt-grass, and tule. The surface at the present time shows no salt, and but little indication of alkali. Grain, however, "burns up" when hot weather comes, even though the ground be moist. Garden vegetables look well until blooming time and then die. When sampling the soil at the time stated it was found to be baked quite hard for the first 6 inches; but from that line down to 20 inches, to which depth it was taken, it was "boggy and soft". The soil as received is a somewhat bluish-gray clayey sediment, containing a good deal of small gravel and shells intermixed. Its reaction is alkaline, though not sharply so.

B.—Upland or bench soils.

No. 193. *Loam soil* from the "hog-wallow" tract 5 miles north of Merced city, Merced county, near Huffman's wheat farm; a reddish or brownish loam, rather close and coherent when dry. Sample taken to the depth of 12 inches. The subsoil is nearly of the same character for 3 feet. The surface of this land lies in gentle swells, on which are the characteristic "hog-wallow" hillocks, not very deeply impressed, and therefore not interfering materially with plowing even in fresh land, and almost disappearing after a few years' tillage. The wheat product is from 25 to 30 bushels per acre in fair years on fresh land.

No. 704. *Fresno plains soil* from Mr. White's place, Central colony, about 2 miles south of Fresno city, Fresno county; a grayish-white, somewhat ashy soil, changing little to the depth of 2 feet or more, then gradually becoming more sandy, sometimes underlaid at a depth of from 1½ to 3 feet by a sheet of calcareous hard-pan, from 8 to 18 inches in thickness, which seems to be merely the subsoil cemented by lime. In planting trees it is sometimes necessary to break through this hard-pan in order to enable the roots to reach moisture. This soil is said to be fairly representative of the country lying to the southward and westward toward King's river and the San Joaquin. To the east and north it passes into the reddish and "sand-hill" soils formed by the streams coming from the foot-hills. (See soil No. 570, from the Eisen vineyard.)

No. 586. *Tulare plains soil*, taken midway between Outside creek and the Sierra foot-hills east of Visalia, Tulare county. Depth taken, 12 inches, with apparently little change for several feet. The tract is quite level, and is treeless. This land does well when irrigated, but has thus far been taken into cultivation less freely than the lands lying nearer the creeks. It is said to be a fair sample of the "plains" proper of this part of the San Joaquin valley, and is of a dun color, quite light and sandy, and not altogether promising in appearance, but bearing a luxuriant growth of wild flowers, which testifies to its productive capacity.

No. 573. *Tulare plains soil* from near the crossing of Cross creek, on the Visalia and Hanford road, Tulare county, taken to 12 inches depth. This soil resembles the preceding, but is of a more grayish tint when dry and darker colored when wet, as a result of its proximity to the creek, which, however, rarely carries water, so that the soil can hardly be accounted an alluvial one. There are decided indications of alkali in the lower portions, and this

is more clearly perceptible where the soil has been cultivated with irrigation, as is the case within a mile or two farther to the west. The country is altogether treeless, but in spring-time bears a luxuriant growth of bright flowers.

No. 700. *Salt-grass soil*, forming a belt on the western edge of the plains east of Buena Vista slough, Kern county; a yellowish gray, fine sandy soil, nearly the same in character to a depth of several feet. Sample taken to 12 inches. Much salt-grass, and but little herbaceous vegetation beside. When irrigated, this soil produces as much as 40 bushels of corn to the acre. It has been but little cultivated thus far, being chiefly pastured.

Alluvial or lowland soils of the San Joaquin region.

	San Joaquin county.		Merced county.		Fresno county.	Tulare county.			
	near Stockton.		Farmers' ditch.	near Hopeton.	near Fresno.	near Visalia.		near Grangeville.	"Dry bog" soil, Tulare lake.
	Black adobe soil.	Hard-pan, subsoil of adobe.	Valley soil.	Bottom soil, Merced river.	Brown adobe, Eisen vineyard.	"Dry bog" soil, "hog-wallows."	"Wire-grass" soil.	Alluvial soil, Mussel slough.	
	No. 6.	No. 7.	No. 195.	No. 198.	No. 570.	No. 701.	No. 585.	No. 579.	No. 77.
Insoluble matter	72.058	64.903	75.405	73.120	76.622	67.519	66.470	79.518	67.34
Soluble silica			8.286 / 83.691	3.882 / 77.002	2.870 / 79.492	4.259 / 71.778	4.950 / 71.420	3.219 / 82.737	
Potash	0.396	0.248	0.423	0.569	0.714	0.562	1.224	0.700	1.05
Soda	0.479	0.404	0.125	0.094	0.444	0.657	0.677	0.286	0.84
Lime	1.927	8.502	0.758	1.316	1.769	2.599	3.043	1.246	6.51
Magnesia	1.640	2.700	0.621	0.547	2.048	0.753	0.087	1.578	3.96
Brown oxide of manganese	0.056	0.034	0.038	0.036	0.041	0.066	0.030	0.018	0.04
Peroxide of iron	6.815	5.672	4.452	9.078	3.728	5.599	5.823	4.030	5.05
Alumina	11.629	6.252	6.331	5.090	7.988	12.395	7.137	6.578	7.97
Phosphoric acid	0.179	0.324	0.048	0.132	0.038	0.074	0.239	0.069	0.32
Sulphuric acid	0.037	0.056	0.046	0.094	0.074	0.145	0.655	0.019	0.08
Carbonic acid	.....	6.229	.....	.....	.....	0.083	2.546	.....	4.42
Water and organic matter	5.871	4.860	3.882	5.991	3.244	4.495	7.091	3.049	3.71
Total	101.078	100.184	100.415	99.949	99.580	99.206	99.972	100.310	101.29
Humus	.....	.....	0.867	1.800	0.597	1.061	.....	0.644	0.468
Available inorganic	.....	.....	0.595	0.563	0.373	0.984	.....	0.587	2.184
Available phosphoric acid	.....	.....	.....	0.130	0.020	0.039	.....	.....	.....
Hygroscopic moisture	.....	.....	5.480	5.671	5.430	11.194	8.530	3.889	.....
absorbed at	.....	.....	.....	.....	.....	.....	.....	.....	15 C.°

Upland or bench soils of the San Joaquin region.

	Merced county.	Fresno county.	Tulare county.		Kern county.
	Loam soil, "hog-wallows", 5 miles north of Merced.	Central colony, Fresno plains soil.	Plains soil, Outside creek.	Plains soil, Cross creek.	Salt-grass soil, Buena Vista slough.
	No. 193.	No. 704.	No. 586.	No. 573.	No. 700.
Insoluble matter	80.328	85.874	73.774	66.079	87.060
Soluble silica	4.345 / 84.673	2.705 / 88.579	3.491 / 77.265	3.378 / 69.457	1.980 / 89.040
Potash	0.347	0.340	1.221	1.817	0.492
Soda	0.058	0.248	0.149	0.436	0.305
Lime	0.508	1.163	1.173	4.307	1.198
Magnesia	0.588	0.499	1.751	1.585	1.069
Brown oxide of manganese	0.016	0.034	0.027	0.078	0.025
Peroxide of iron	4.772	3.276	5.673	6.041	5.822
Alumina	6.165	3.221	7.799	8.692	0.171
Phosphoric acid	0.023	0.097	0.103	0.138	0.079
Sulphuric acid	0.006	0.117	0.003	0.263	0.133
Carbonic acid	.....	.....	.....	2.533	.....
Water and organic matter	3.278	1.789	4.351	4.150	1.130
Total	100.434	99.363	99.515	99.497	99.464
Humus	0.367	0.604	1.139	0.996	0.170
Available inorganic	0.334	0.351	0.535	0.740	0.195
Available phosphoric acid	0.019	0.011	.....	.....	0.069
Hygroscopic moisture	4.212	2.217	4.618	8.735	2.164
absorbed at	15° C.	15° C.	15° C.	15° C.	15° C.

A glance over the preceding tables of soils of the San Joaquin valley shows at once that, like those of the Sacramento division, they nearly all agree in having a large percentage of lime; in only one case as little as half of one per cent., in most cases over and ranging as high as 3 per cent.

All these soils, except the Stockton adobe, are of a rather sandy or light character, which places them the more distinctly in the class of calcareous soils, and this accounts for the extraordinary thriftiness, when placed under irrigation, of even such as do not show high percentages of phosphates and potash. Thus, in No. 193 (Merced hog-wallow soil) the potash percentage is quite low for California, while that of phosphoric acid is exceedingly low; yet these soils have yielded from 16 to 25 bushels of wheat per acre for several years consecutively. They will doubtless, however, soon require the use of bone-meal for the maintenance of production. The same deficiency of phosphoric acid occurs in the bottom soil No. 195, also from northern Merced. Almost throughout, the percentage of phosphoric acid in the soils of the San Joaquin valley is only moderately high, many falling below one-tenth of one per cent. and only two rising above two-tenths. These latter are Nos. 585 and 77, both alkaline soils, in which probably the soluble phosphates have accumulated near the surface (from which the sample was taken), doubtless, in part at least, at the expense of the surrounding uplands. It follows, that while in the lowlands that are more or less impregnated with alkali both potash and phosphates are comparatively abundant and will not require replacement for a long time to come, in the uplands the phosphates will be the first to become exhausted, when bone-meal and superphosphates will come into heavy demand. On the other hand, the use of lime as a fertilizer will scarcely ever be called for in the San Joaquin valley, and potash manures will not be needed for a long time to come, even in the uplands, and never in the lowlands.

It is important to note this corroboration of the opinion expressed in a previous report (*a*) as to the superior value of the "alkali soils" when once properly reclaimed and cultivated with a view to the repression of the "rise of the alkali" to the surface; for we find that, with the worthless or injurious excess of salts, there is almost always associated a large supply of soluble or at least available plant-food, which will render these soils remarkably durable and thrifty.

For the discussion of the measures and precautions needed for the reclamation of alkali soils the reader is referred to pages 63 to 73.

There is another point shown in these analyses worthy of note. The traveler on the San Joaquin plains will, during the dry season, imagine that the gray dusty soil of the plains is destitute, of or at best very poor in, humus or vegetable mold. The figures given in the table show that this is far from being the case, for even the white soil of the Fresno plains shows six-tenths of 1 per cent. of humus, and that of the sandy Tulare plains 1 per cent. and over. It is here again the lime, so abundant in these soils, that helps to retain the humus, despite the prolonged action of the hot summer's sun. Of the soils examined, two only are really deficient in humus, viz, No. 193, the Merced hog-wallow, and No. 700, the salt-grass soil of Kern. In the case of the latter the alkali present dissolves the humus and allows it to be washed away into the sandy subsoil below, and this happens more or less in all alkali soils containing much carbonate of soda. It is therefore doubly important that this ingredient should be gotten rid of by the use of gypsum when such soils are put under cultivation, especially with irrigation.

In the case of the Merced hog-wallow soil, the poverty in humus is obviously attributable to its "hard-pan" nature, through which, in its natural condition, the mold remains on the surface, and is "burnt out" by the sun during the dry season. The thriftiness of such soils would doubtless be very much increased by plowing under some green crops.

As to retentiveness of moisture, there are but two soils in the list that fall below the limit usually deemed desirable. One of these is the white plains soil south of Fresno (No. 704), and the other is the salt-grass soil (No. 700) from Kern. The latter is notably deficient both in humus and clay, and what moisture it does retain is probably partly due to the alkali present. In the Fresno soil, considering the amount of alumina shown in the analysis and the humus present, the moisture absorption is unexpectedly low and in urgent need of being raised by means of green-manuring. It will also be especially advisable that, wherever the crust of hard-pan underlies the soil at a depth of less than three feet, that impervious layer should be broken up or through, in order to enable the roots to seek for moisture at the depths allowed them by this very easily penetrable and deep soil.

This great depth of soil, which is observable more or less over the whole of the San Joaquin valley, is of the utmost importance with respect to the permanence of productiveness; for the soils being mostly very pervious and loose, and the water-table, even where irrigation is practiced, quite low, the plant is enabled to draw for its food upon a much greater mass of soil than would be the case where the latter is heavier and perhaps richer in plant-food but less easily penetrated by the roots than are sandy soils. In the case of the San Joaquin soils, moreover, examination shows that much of the sand is not quartz, but pulverized rock still in process of decomposition and soil formation.

Soil No. 77, from the land left by the recession of Tulare lake, presents a peculiar phase of the "alkali soil" question, which is discussed more in detail on page 69. The results of the mechanical analysis, given on page 83, show this soil to be within the limit of moderately clayey ones, and, considering the large amount of lime present and the uniform

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a Report of the California College of Agriculture, 1879, page 35.

distribution of sediments, it ought to till well. The chemical analysis, so far as the chief ingredients of mineral plant-food are concerned, shows the general composition of the soil to be excellent. The amounts of potash and phosphoric acid are equal to those of the most productive soils of the Yazoo bottom, and the large percentage of lime should insure thriftiness. But it is evident, from its alkaline reaction and the large percentage of soda shown in the analysis, that it contains enough of true "alkali" to interfere seriously with tillage as well as with the welfare of vegetation. At the same time the solution formed by hydrochloric acid showed the want of aeration in giving an indication of iron protoxide. These inferences are corroborated by the observations made by the owner of the tract, that wheat made some fine ears on the upper part of the levee, where, of course, the rain had washed out some of the alkali, and where also the air had free access. It was therefore recommended that the land be given a full dressing of plaster to neutralize the carbonate of soda, and that it be well and deeply fallowed; but a subsequent investigation having shown that the water of Tulare lake is not available for irrigation on account of an excessive percentage of alkali of similar character, the reclamation project was for the time abandoned. Considering the great native fertility of this soil, the reclamation of the wide belt of similar land that surrounds the lake and is constantly widening by its recession would be a matter of great importance to the state, and is well worthy of further experiment. Success is, of course, dependent on the command of an adequate supply of irrigation water, but whether from King's river or from artesian wells is a question for future determination. Taking all the evidence of possible productiveness in this portion of the great valley, the importance of utilizing fully and economically the water resources of the adjacent mountains cannot easily be overestimated.

TULE LANDS.

This is the name applied in California to all lands, whether littoral or inland, bearing as an important ingredient of its vegetation the tule or rush, which, of course, varies in kind according to location near to or remote from saline tide-water. In the coast marshes the tule is prevalently the rush, properly so called (*Scirpus lacustris*), while the tule of the fresh-water marshes in the upper portion of the delta of the Sacramento and the San Joaquin, as well as in the upper portions of the courses of these rivers, consists largely of other species, notably the cat-tail rush (*Typha*). All these lands are, of course, subject to overflow, and need protection by levees.

The surface of the marsh lands is covered with a matted mass of roots from one foot to several feet in depth, in all stages of decay, the lower portion being in a peaty condition, and sometimes available for the manufacture of peat. Occasionally this mass is afloat, so as to rise and fall more or less with the water; in most cases, however, a solid sediment soil of high productiveness underlies the roots at a moderate depth.

The prevalently bold and rocky coast of California presents but few and small marsh areas outside of the great valley and bay regions. On San Francisco and San Pablo bays the tule lands do not differ materially from the salt and brackish marshes elsewhere, and their reclamation is effected by similar methods. Passing Carquines straits, however, we come upon a wide expanse of marsh, in which the water is fresh, or only slightly brackish in the lower portion. These tule lands constitute here the delta of the two great rivers of the valley, whose numerous sloughs and creeks form an intricate network of meandering channels, through which only a practiced native can find his way to a definite point. They form a large body to the northward of Suisun bay, and then, after narrowing for 10 miles to a width of 3 or 4 miles, they expand to a broad belt, which covers the western part of San Joaquin and Sacramento counties, and thence continues northward along the Sacramento river far into Colusa county. To the southward they form only narrow and interrupted belts along the San Joaquin river until we reach the basin of the upper valley, where long belts of tule lands, 5 or 6 miles in width, extend northwestward and southeastward from Tulare lake, and also form a broad rim around that lake itself.

The tule lands of the Sacramento valley differ in several important points from those of the Tulare basin and of the San Joaquin valley generally. The latter are mostly strongly tainted with alkali, and on that account are somewhat difficult of reclamation, although of high fertility when reclaimed. The more abundant rainfalls and drainage of the Sacramento valley practically obviate this difficulty in the case of the northern tules, the sole question being that of drainage and the exclusion of overflows.

The soil of the Sacramento valley tules, when reclaimed, is mostly of the character of adobe, mingled more or less with the fine river sediment, resembling so closely the soils of the adobe belts, now largely above overflow, as to create the presumption that the latter indicate the areas over which tule swamps extended in ancient times. At high stages of water in winter and spring the tule areas are, as a rule, submerged to varying depths, the exception being the singular "float-land", of which tracts sometimes several acres in extent rise and fall with the water occasionally as much as 3 and even 4 feet, serving at times as a place of refuge for cattle. In such spots the matted mass of tule roots and decayed stems is found to be from 8 to 12 feet in thickness, with no solid bottom, but simply water immediately beneath. They are chiefly found in the lower portion of the San Joaquin delta.

Where the round rush or tule (*Scirpus lacustris*) chiefly prevails solid ground is commonly found immediately beneath the mass of tule roots at a depth varying from 18 to 24 inches, and sometimes even more. In the dry climate of the region these roots decay very slowly, hence, where of great thickness, they are frequently set on fire during the dry season; their ash serves to still further enrich the underlying soil while at the same time

rendering it accessible to the plow. It has been, and is even now, a not uncommon practice to sow the grain into this ash the first season and then have it trodden in and the ground compacted by sheep, and in favorable seasons crops of wheat thus grown have reached the enormous yield of 80 bushels per acre.

Such results could not fail to excite great interest in the reclamation of the tule lands, and much capital has been invested in leveeing and draining large tracts, especially in San Joaquin and Sacramento counties. Since the natural moisture of these lands renders irrigation unnecessary, grain crops on them are assured, provided the overflow be excluded, and are generally best in seasons when, from want of moisture, crops fail in the unirrigated uplands. Much difficulty is sometimes experienced in levee building from the lack of material of sufficient weight to resist the buoyant pressure of the water, which will not only filter through the tule sods when used for the purpose, but has occasionally floated the levee bodily down stream.

So far as not reclaimed for cultivation the tule lands serve during the dry season as an eligible pasture ground for cattle, and more or less at all times, but especially during winter, as a resort for innumerable water-fowl (notably geese and ducks), which often commit severe depredations upon the adjacent grain-fields.

Among the more important portions of the northern tules that have been successfully reclaimed is a number of "islands" lying between the San Joaquin and the Sacramento, viz, Union, Roberts, Staten, Boulder, Rough and Ready, Sherman, Brannan, and Andrus. On these nearly every product adapted to the climate is successfully cultivated; and, contrary to expectation, human health on reclaimed tules is on the average better than on the adjacent bottom lands. At some points, notably on Suisun bay, there appears to be "no bottom" beneath the sod, and the road-bed of a branch of the Central Pacific railroad crossing this marsh has again and again disappeared under the surface over night or behind a passing train, and thousands of car-loads of gravel and rock have sunk out of sight without apparently definitively filling the "bottomless pit".

The tule lands of the upper San Joaquin valley have not as yet been reclaimed to any great extent, partly, as before stated, on account of their alkaline character. The soils mostly contain a large amount of coarse sand, which, however, does not prevent their having the character and name of adobe. Much of the land now being laid bare by the recession of Tulare lake is of exuberant native fertility, as is shown by the analysis given on page 28 (see No. 77), but can be made practically productive only by the neutralization and partial removal of the alkali. Small tracts so reclaimed have fully justified in their production the presumption created by the analysis. The natural pasture, however, can be, and is, freely utilized, it being noted that hogs especially fatten quickly upon a diet of succulent tule roots. The following description is from Mr. Sherman Day, formerly of Bacon island:

Float-land sod.—This reaches to an unknown depth, perhaps from 7 to 10 feet, but at 10 feet the hard bottom is not reached, only slum and water. Probably hard sandy bottom would be reached at from 24 to 28 feet from the surface. In dry seasons the seepage water reaches to within 2½ feet of the surface, but in rainy seasons it stands within from 1 to 6 inches of the surface.

The sod of the *heavy round bulrush land* is characterized by the large woody or corky roots diffused through the mass of smaller fibrous roots of the grasses. Besides the large tule roots, there are sometimes the still larger roots of the pond lily. Below them is the mass of soil and fibrous roots, interspersed with a few of the corky roots. The seepage water is usually about 3 feet below the surface when the levees are in proper condition. The depth of the soil is not known. Furrows are run in this 4 or 5 inches deep, and when the furrow sods have dried for six or eight weeks they are set on fire and burned down very evenly to the depth of the furrow and a trifle below, according to the absence of moisture. This kills the heavy tule roots and checks the growth of grass. The seed is then drilled in under the ashes after they have become wet by the rain, or it is trodden in by bands of sheep. The ashes leach about enough the first year to correct any acidity of the peaty sod, but their principal function the first year seems to be as a mulch to shade the soil during the early growth of the plant. If the seed is not pushed down so that its first roots take hold of the black soil, the blackbirds pull up the plumule from the loose ashes. The crops thus sown under the ashes are usually very abundant, having scarcely any competition from weeds. Sometimes a volunteer crop is gathered the second year, but, as a general rule, these crops carry too many weeds to do well on the tule lands. The ashes are usually plowed under the second year.

The coarse bulrush and underlying sods make but little progress toward decomposition by mere exposure to the atmosphere; the float-lands decompose more readily.

THE FOOT-HILLS OF THE SIERRA AND NORTHERN COAST RANGE.

The western slope of the Sierra Nevada mountains embraces a belt of country falling in elevation from 4,000 feet at the foot of the mountains westward to less than 500 feet at the border of the great valley of Sacramento and San Joaquin, and varying in width from 50 to 70 miles on the north and center, but becoming very narrow on the south. The higher portion of this belt, immediately along the foot of the mountains, and from 4,000 down to 2,000 feet altitude, possesses many of the characteristics of the Sierra range in its high, mountainous, and extremely broken surface, and is therefore described as a subdivision of that mountain region. The remainder of this belt, or that having an elevation of about 2,000 feet down to that of the great valley, is distinct in its topography, climate, and agricultural features, and is that to which the designation of *Sierra foot-hills* has been given.

This belt, with the same characteristics, continues around the head of the Sacramento valley, in Tehama county, forming there a region of *Coast range foot-hills*, which, from similarity of soil, may be considered as continuing in a narrow belt southward into western Yolo county.

These foot-hills of the two ranges of mountains are estimated to cover an area of about 11,700 square miles. The Sierra belt has a width varying from 30 to 40 miles from Shasta southward to Mariposa county, and thence is very narrow, usually about 5 miles, widening in Kern, and terminating, with the Sierra, against the Coast range near

Tejon pass. The following counties and parts of counties are included in the belt of Sierra foot-hills: The middle and southern parts of Shasta, most of Tehama, eastern parts of Butte and of Yuba, the western parts of Sierra, Nevada, Placer, El Dorado, Amador, Calaveras, Tuolumne, and Mariposa, small strips along the eastern edge of Sacramento, San Joaquin, and Stanislaus, and a narrow belt southward from Mariposa through Fresno, Tulare, and Kern.

The foot-hills of the Coast range occupy a broad region in the western part of Shasta and Tehama counties varying in width from 10 to 40 miles; but in the western part of Colusa county it suddenly contracts, and southward to Cache creek, in Yolo county, its width varies from 6 to 10 miles, and often less, while still southward to the bay the hills occur as outliers to the Coast range.

While more or less adapted to all the products grown in the valley, the foot-hills are now noted as a fruit-growing region, and probably will be still more noted in the future, including, especially in its northern part, the very successful culture of the vine.

THE FOOT-HILLS OF THE SIERRA.

A line marking the separation between the foot-hills and the great valley would pass from the Sacramento river, north of Red Bluff, in Tehama county, southeastward to the following principal points: 3 miles east of Chicot and a short distance west of Oroville, Butte county; 10 miles east of Marysville to Rocklin, Placer county, and Folsom, Sacramento county, and thence southeastward, nearly following the county-lines, via Knight's ferry and Merced Falls, to Fresno county.

This region is watered by many streams, that cross it from east to west in their course from the mountains to the great valley, joined by many small tributaries from the region itself. Cutting their way, as they do, in narrow cañons or valleys between the hills, they have, as a rule, but little bottom land, and even then, because of their liability to floods during the rainy season, these lands are often not available for farming purposes. These streams have been more fully described on pages 19 to 21.

The foot-hills of the Sierras are properly divided into three separate and distinct regions, differing in their topographical and lithological as well as in their agricultural features. These are a barren *lava-bed region* on the north, a *granitic region* adjoining this and also on the extreme south of the foot-hills, and a central or auriferous region, the real *foot-hills* of the eastern side of the state. These subdivisions are best described separately.

THE AURIFEROUS BELT, OR FOOT-HILLS PROPER.—The foot-hill region of the Sierra is known as the gold belt of the state, for here most of the mining operations have been carried on and the greater part of the metal has been obtained that has given to the state its prominence in this regard.

The gold-bearing rocks comprise a belt of from 10 to 25 miles in width, reaching from Butte county southeastward into Mariposa, and embracing metamorphic slates and sandstones. North of the belt these rocks are covered by lava beds and other volcanic material.

In the extreme southern portion of the gold region, beyond Mariposa county, the slates almost cease to form a continuous belt, and they are more and more encroached on by the granite as we go toward the Tejon. In fact, there is a gradual decrease in the width of the auriferous formation proper from the north toward the south and a constant increase in the amount of metamorphism displayed, the granite occupying a larger portion of the mass of the Sierra and descending lower down its flanks, while the crest of the mountains becomes more and more elevated, its culminating point being in about the latitude of Owen's lake.—*Report Geological Survey of California.*

The eastern part of the region is well timbered, much broken, and very sparsely populated; the western is thinly timbered, but, being less broken and better adapted to cultivation, contains nearly all of the population.

The following description is taken from a paper by B. R. Redding, esq., read before the California Academy of Sciences:

At the northern end of the valley, at an elevation of 500 feet above the sea, are found *Quercus lobata, Sonomensis, Wislizeni, chrysolepis,* and *Douglasii,* of the California oaks; of pines, only the nut or digger pine (*Pinus Sabiniana*); the buckeye (*Æsculus Californica*); and chamisal (*Adenostoma fasiculata*). (*a*) This is the characteristic arboreal vegetation throughout these 350 miles. Its presence everywhere shows increased rainfall over the valley and similarity of temperature to that of the valley. Our pasture oak (*Quercus lobata*) is found at lower elevations in the valley, but always on moist land or near river courses, proving that it demands, in addition to temperature, the increased moisture. In the southern end of the valley this vegetation prevails at higher elevations, because it there finds the proper temperature and moisture. Wherever on the foot-hills any of the trees named constitute the predominant arboreal vegetation, it is evidence that the temperature is the same as that of the valley, and that plants that can be successfully grown in the valley can be grown to as high an elevation on the hills as these trees abound. If one tree were to be taken as the evidence of this uniformity of temperature, it would be Sabin's (the nut or digger) pine. It is never seen in the valley or on the hills below an elevation of about 400 feet. It is not found at a higher elevation than that in which the temperature is the same as that of the valley. It is never found in groves, but singly among other trees; yet it prevails throughout these 350 miles of foot-hills.

While the vegetation is more dense on the hills at the northern end of the valley, due to increased precipitation, there are also local differences, where there is similarity of soil, due to exposure. Throughout all the lower hills the greatest number of trees is found on gently sloping eastern, northeastern, and northern hills, which necessarily are more moist and cool. The southern aspects contain less trees, because exposed to the direct rays of the sun and to the full force of the prevailing winds.

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a To these should be added, in the northern portion especially, the manzanita (*Arctostaphylos Andersoni, pungens, tomentosa*) and several species of chaparral (*Ceanothus,* notably *C. crassifolius, cuneatus,* and *thyrsiflorus,* the latter more particularly to the southward, where it is so abundant as to serve for fencing).

Every agricultural product that can be grown in the valley, including the semi-tropical fruits, can be grown with equal facility in these foot-hills. Ordinarily the land has to be cleared of the trees found upon it, and cultivation must be continuous; for on the whole western face of the Sierra the native trees, when cut or burned down, are rapidly replaced by a new growth of the same kinds.

These lands are found to have all of the requisites for the successful growth of orchards. Fruit trees thrive better upon them than on the lands of the valley. None of the many theories advanced as to the cause of the treeless condition of many plains and prairies having ample rainfall seem to be entirely satisfactory, but experience has demonstrated that orchards grow best and thrive with less artificial aid on lands that in a natural condition are covered with trees.

The increasing exports of small fruits, such as strawberries, blackberries, and raspberries, from the vicinity of Newcastle and Auburn, and their superior size and quality, prove that this region is better adapted to their culture than any place yet found on the level lands of the valley. The peaches of Coloma have a stall reputation for flavor and size. The apples of Nevada and Georgetown are equal in size, taste, and keeping qualities to the best imported from Oregon. The Oroville oranges have been pronounced equal to the best of Los Angeles. The vine grows with luxuriance and bears abundantly wherever it has been planted throughout all this region. The wines of Coloma have more than a local reputation. Persons competent to judge assert that wine from grapes grown on the foot-hills is free from the earthy taste that characterizes much of the wine of the flat land of the valleys. They also express the belief that if ever wine is to be made in California as light as that from the Rhine and as free from alcohol, the grapes will be grown in the higher elevations of the foot-hills, where snow falls and remains on the ground a few weeks each season. It is said that the long summers and great heat of the valleys develop the saccharine matter in the grape, which, by fermentation, is converted into alcohol.

In Butte county the line separating the foot-hills from the great valley is well defined, the surface of the former being not only undulating, but broken and barren, and with an abundance of bowlders. For the first 8 or 9 miles eastward the soil is said to be thin and volcanic in character. All of the lands of the region are red and gravelly, mostly destitute of trees, and on the hills barren, those of the valleys being best suited for cultivation.

In Yuba county the country near the valley is at first rolling, but it becomes more and more hilly, rocky, and brushy to the eastward. The soils of the western part are chiefly red and pebbly clays, and on the lower hills are well adapted to fruit trees and vines. These red lands reach across Nevada county, interspersed with granitic lands, into Placer, where they are the prevailing soil on the broken hill country from the foot of the Sierra to the belt of granite 2 miles west of Auburn. The timber growth is white, live, and black oaks, buckeye, and chaparral.

In the counties southward the same general features are seen: a low, rolling country, sparsely timbered with an oak growth, rising into higher and more heavily timbered hills toward the Sierra mountains. The soil is also a reddish or brownish loam, tillable, however, only in the valleys or on the low hills of the western part of the belt. Lumbering is the chief industry in the eastern part of these counties, and as a matter of interest concerning the timber growth the following extract from a letter of a correspondent of the *San Francisco Bulletin* is given:

The timber belt of Mount Diablo parallel commences on the Stanislaus river, 40 miles east of Stockton, by the appearance of straggling oaks on the bluffs, which are from 40 to 150 feet above the water. As the rock-bound surface gradually rises these trees attain a larger size and become more numerous, especially in depressed locations, where deposits of soil have been made. In no place within sight, until reaching Chinese Camp, is there an average of over one acre of well-timbered surface to the square mile. At Chinese Camp the digger or nut pine begins to appear, interspersed among the oaks. The surrounding hills have before this begun to assume the magnitude of mountains, near the middle and rounded top of which this tree may clearly be distinguished in the distance. From Chinese Camp to Columbia, 16 miles, there is no material change in the sylvan vegetation, except an increasing density of this pine growth, with an occasional appearance of Sabin's pine. Columbia may be considered the starting-point of the great pine forest which extends east to the upper foot-hills of the Sierra, 60 miles. The southeast limit of this range is said to terminate at Yosemite ridge, below which the timber is in patches; to the northwest it extends into Oregon. Besides the pines, cedars occupy a prominent position in the sylva of this belt; commencing at an altitude of 4,000 feet, they gradually increase in numbers, till in some spots they have precedence of all others. The black oak is interspersed in moderate quantities among other trees.

A prominent feature in the topography of Amador, Calaveras, and Tuolumne counties is the occurrence of belts of lava-capped hills and mountains, as well as deposits of other volcanic material, the remains of what were once lava flows from the Sierra mountains westward. Table mountain, rising some 2,000 feet above the Stanislaus river, has a length of about 30 miles, its flat top being from 1,200 to 1,800 feet wide. At Texas Flat, Tuolumne county, there is a vast accumulation of calcareous tufa formed over the auriferous gravel in an ancient gulch emptying into the Stanislaus river, where it rises in picturesque cavernous cliffs resembling coral reefs. In this tufa are found the bones and teeth not only of the mastodon, elephant, and other gigantic animals, but also of the horse and other mammalia, together with land and fresh-water shells.

In Mariposa county the foot-hill region is narrow and its hills low and tillable, though but little farming is done. The soil of the hills is a reddish clay, while the valleys are covered with a dark loam.

THE GRANITIC REGION.—A belt of granite having a width of about 10 miles reaches from Feather river southward through Butte, Yuba, Nevada, and Placer counties into El Dorado county and the northeastern corner of Sacramento, near Folsom. In Nevada county especially this rock is very abundant, outcropping in large areas, the chief belt passing a little east of Grass valley, northward by San Juan, to Feather river. The rock appears in large masses and in weathered bowlders, giving rise to sandy and gravelly lands, while the surface of the country is broken into the rounded hills characteristic of granitic regions. Southward in other counties as far as Mariposa granite appears occasionally in smaller belts, and outcrops among the slates and metamorphic rocks of the foot-hills. Still southward from Mariposa to the limit of the foot-hills it is the prevailing rock, with a bordering narrow belt of slate, which, with its occasional capping of Tertiary sandstone, gives to it a broken character, its valleys being covered with sand and gravel.

REGION OF LAVA BEDS.—The lava beds cover nearly the entire foot-hill region north of Feather river, Butte county, reaching also far northward across the Sierra region to the Oregon line, their western limit being the

Sacramento river. The region is described on page 62 as a subdivision of the Sierra mountain region. The lava beds are said to terminate not far from the river in abrupt edges, the plains below being also covered with volcanic fragments. The streams have cut their way through the lava, in gorges some 200 feet deep, into the Cretaceous beds that underlie it. The surface of the lava bed is usually destitute of vegetation and of soil of any depth. In Shasta county, between Cow and Bear creeks, the hard lava gives place to a broad plain of volcanic ashes, which is said to be almost destitute of trees and bare of herbage, and, as yet, hardly eroded into cañons.

Very little of the entire lava region is suitable for cultivation, though some of the streams have a little fertile bottom land.

In Tuolumne and adjoining counties there are other table-lands and hills of basaltic lava, which form a prominent feature of those counties. They are described in connection with the Sierra mountain region.

THE FOOT-HILLS OF THE COAST RANGE.

Assuming the Sacramento river to be the dividing line between the foot-hills of the Sierra and those of the Coast range in Shasta and Tehama counties, we find the latter region occupying a large area in the southwestern and western portions of those counties, the maximum width in Shasta being about 35 miles. Its surface is rolling and broken, interspersed with many small valleys, and is but sparsely timbered. These hills are too broken for cultivation, and the farms lie chiefly in the valleys. The soil is mainly a red and gravelly loam, and when under cultivation yields good crops of grain. The higher valleys are mostly devoted to grazing purposes. This region is well watered by many streams, which, rising on the Coast mountains, flow eastward into the Sacramento river.

In Colusa county the foot-hills become more and more broken toward the foot of the Coast range, and are partly covered with an oak growth and partly with laurel, manzanita, and chaparral. The cultivable land lies chiefly in the several valleys among the hills, viz, Indian, Bear, and Cortina, with lengths of from 10 to 30 miles and widths of from 2 to 5 miles. Their soils, largely red and gravelly loams, are partly under cultivation. In the southern part of Colusa county the region flattens out, but in Yolo county it rises into a belt of low, rolling hills, which reach eastward to within 3 miles of the railroad and southward to Cache creek, and even beyond, to within a few miles of Woodland. Its width is about 4 miles, and its soils are mostly dark and gravelly, with tracts of red lands. Fairview valley, on the west, a "hollow" some 2 or 3 miles wide, separates it from the Coast range. On the south of Cache creek the foot-hills become a very narrow belt, reaching to and a little beyond Vacaville, Solano county, and embracing a region south of Putah creek known as the "Vacaville fruit belt". Southward still to Suisun bay there are but a few low, isolated hills to mark the termination of the belt.

The Vacaville fruit belt is about 12 miles long and from 1 to 3 miles wide, embracing Vacaville and Pleasant valleys and foot-hills, and is limited on the south by the Montezuma hills. These valleys open out into the Sacramento valley, and their soils are chiefly dark loams, with some adobe around the town of Vacaville. A portion of the region is in what is known as the thermal belt of the Coast range, lying a few hundred feet above the plains and above frost limits. The hills are partly timbered with scattered oaks, buckeye, etc., and where not too steep are, with the valleys, very largely under cultivation.

Soils of the foot-hills.

The following analyses have thus far been made of soils of the foot-hill region adjoining the great valley. While no systematic exploration of the region has made it possible to select the samples advisedly and systematically, yet it is probable that the main features of the "red soils" are represented within the list:

No. 559. *Red loam soil* from near Redding station, Shasta county, collected by Mr. N. J. Willson, of the Central Pacific railroad. This is a moderately heavy red-clay loam, with some gravel and but little coarse sand, which probably is somewhat heavy in tillage unless when just in the right condition. No notes regarding this soil have reached me, but it is stated to be the representative soil of the region around Redding.

No. 705. *Red chaparral soil* from a few miles west of Anderson, Shasta county; sent by Mr. George A. Moore, of Anderson, who states that this land is covered with a dense thicket of chaparral (*Ceanothus*) and poison-oak, with some small oaks and other brush. Depth taken, 12 inches. This soil is of a deep orange-red tint, and is quite heavy and cloddy when dry. The lumps cannot be crushed with the finger, but soften readily with water, and then show a considerable amount of coarse sand to be present.

No. 706. *Subsoil* of the above, taken from 12 to 24 inches depth; similar in aspect to the soil, but more clayey and less tractable, the clods also softening when wet. Mr. Moore says that "about 4 feet from the surface there is such a compact mass of clay and gravel that water does not penetrate over 15 inches from the surface".

No. 499. *Red upland loam soil* from near Wheatland, Yuba county; a stiffish, glaringly orange-red loam, forming the soil of the undulating uplands and stretching from the foot-hills several miles into the valley, and but little above the general level of the latter. This soil tills easily when taken in the right moisture condition, but plows very cloddy when either too wet or too dry. It is chiefly given to pasture and wheat-growing, and yields from 15 to 20 and sometimes 25 bushels of fall or winter-sown grain in good years, and in poor ones from 11 to 13 bushels per acre, but never altogether fails. It responds very kindly to summer fallowing, and in its natural condition has little else than herbaceous vegetation, with some scattered poison-oak bushes.

No. 51. *Red surface soil* from the foot-hills near Auburn, Placer county, taken 12 inches deep; sent by Mr. N. S. Prosser, of Auburn. Original vegetation, oak (*Q. Douglasii*), pine, and chaparral. This is a fair sample of

the red soil of the placer mines, which seems to contain a small amount of gold everywhere, and has been washed on the small scale ever since the first discovery of gold in California. It is of a dark orange color, rather light in tillage and pulverulent when dry, forming a very fine reddish dust of considerable repute. It contains throughout numerous fragments of slate, more or less decomposed, of all sizes, and is usually underlaid by the same or its *debris* at a variable depth, rarely less than several feet, unless lying on steep slopes.

No. 190. *Red loam soil* from the foot-hill slopes near Lagrange, Stanislaus county. Vegetation, scattered oak timber (mainly blue and white oaks), with little or no underbrush save some poison-oak; also grass and flowers. This is a moderately heavy, glaringly orange-red loam, tilling well unless when very wet, contains but little gravel, and is not much in cultivation, save in gardens in this neighborhood; makes fine vegetables and fruits. Sample taken to 12 inches depth.

No. 191. *Red foot-hills soil*, taken two miles north of Merced Falls, on the Lagrange road, Merced county; depth, 10 inches. This is a rather heavy brownish red-clay soil considerably mixed with gravel. The natural vegetation is grass and scattered "blue" oaks, chiefly pastured at present, but capable of producing from 15 to 20 bushels of wheat per acre in good seasons and with good tillage.

No. 196. *Red gravelly soil* from the rolling "hog-wallow" country about eleven miles north of Merced city, on the Hopeton road, Merced county. This represents a rolling tract of foot-hill country extending southwestward from near Merced Falls, and, gradually flattening out, terminating near the railroad between Atwater and Merced stations. The surface, even to the hilltops, is deeply scored into "hog-wallow" mounds, separated by a maze of little channels filled with gravel, and sometimes with cobble-stones. In low, undrained places of this tract lies the "dry bog" soil, of which No. 701, from Tulare county (see pages 27, 28), may be taken as representing the best class. Land like No. 196 is not at all cultivated at present; but on the flanks of the ridgy tract lie lands like those at Huffman's (see No. 193, pages 27, 28) where grain-culture is very successful. The country is treeless and free from underbrush.

Soils of the foot-hills region.

	Shasta county.			Yuba county.	Placer county.	Stanislaus county.	Merced county.	
	Redding station.	Near Anderson.		Near Wheatland.	Near Auburn.	Near Lagrange.	Near Merced Falls.	Eleven miles north of Merced.
	Red soil.	Red chaparral soil.	Red chaparral subsoil.	Red-loam soil.	Red foot-hills soil.	Red foot-hills soil.	Red foot-hills soil.	Hog-wallow soil.
	No. 559.	No. 705.	No. 706.	No. 499.	No. 51.	No. 190.	No. 191.	No. 196.
Insoluble matter	76.274	63.384	63.194	78.789	69.52	67.915	73.352	79.078
Soluble silica	4.102 } 80.376	5.480 } 68.864	4.710 } 67.904	3.803 } 82.592		6.964 } 74.879	4.506 } 77.858	5.544 } 84.622
Potash	0.500	0.417	0.467	0.249	0.38	0.352	0.375	0.208
Soda	0.041	0.052	0.044	0.035	0.07	0.126	0.125	0.111
Lime	0.104	0.288	0.327	1.021	0.96	1.544	0.351	0.394
Magnesia	0.403	0.207	0.350	0.471	1.09	0.720	0.840	0.361
Brown oxide of manganese	0.009	0.037	0.029	0.018	0.39	0.031	0.066	0.033
Peroxide of iron	6.686	7.705	6.263	5.811	12.42	7.879	6.964	3.903
Alumina	8.480	14.443	17.434	6.283	10.97	9.864	8.804	6.660
Phosphoric acid	0.036	0.047	0.064	0.043	0.16	0.091	0.067	0.053
Sulphuric acid	0.012	0.074	0.043	0.019	0.01	0.362	0.221	0.082
Water and organic matter	3.968	7.680	7.229	3.644	5.14	3.766	5.060	4.143
Total	100.615	99.814	100.154	100.186	101.11	99.614	100.731	100.570
Humus	.....	1.420	.....	0.466	1.14	0.715	0.712	0.758
Available inorganic	.....	.....	.....	0.336	1.12	0.448	0.467	0.533
Hygroscopic moisture	5.049	9.998	10.749	4.810	.....	5.421	6.114	4.967
absorbed at	15 C.°	15 C.°	15 C.°	15 C.°	15 C.°	15 C.°	15 C.°	15 C.°

The above analyses show that the soils of the foot-hills are more variable in their composition than would be inferred from the general similarity of their appearance, viz: a high orange-red tint, arising from the presence of from about 4 to over 12 per cent. of finely diffused iron oxide (ferric hydrate), and a texture varying from that of moderately heavy loam to a stiff clay, with more or less of rolled gravel, at times to such extent as to impede tillage, and occasionally so closely packed as to render cultivation unprofitable. Their capacity for absorbing moisture is in all cases fair and adequate, and in some cases high.

The supply of lime is hardly adequate for such heavy soils as in the case of those from Shasta county. In that from Redding lime is deficient, and should be supplied where thriftiness is desired, and the same would be advantageous in the Anderson soils. Farther south the lime percentage increases, being high in the region from Wheatland to the Tuolumne near Lagrange, but again comparatively low in the foot-hills and hog-wallow ridges of Merced county. The superior adaptation of that middle region to fruit, and especially to grape culture, is doubtless connected with this fact. The supply of potash is only moderate, and in some cases low for such heavy soils, as in Nos. 499 and 196. In the case of the soil from Redding, the higher potash supply offsets, in a measure, the deficiency in lime.

As to the supply of phosphates, it is on the average quite low, being deficient especially in the Redding soil, and likewise, considering its heaviness, in the Anderson soil. In the latter case the use of bone-meal, recommended by me to Mr. George A. Moore, has resulted in a surprising improvement of production, thus proving the correctness of the indication furnished by analysis. The soil in its natural state failed altogether to produce remunerative crops, scarcely giving back the seed sown—"about one and a half tons of hay on six acres, and potatoes at the rate of about one-tenth of the bulk planted", as stated by Mr. Moore. The use of lime would doubtless still further help the thriftiness of this soil.

From the small amount of humus shown in the analysis of the Wheatland soil it seems probable that the sample represents a subsoil rather than the arable soil itself, and it may be that in the latter the phosphates would show a higher percentage. In the sample analyzed the phosphates are deficient, but the productiveness would, for the time being, be maintained, in consequence of the presence of so much lime and the greater lightness of the soil. Before long, however, phosphate manures will be desirable in that region.

The soil from Auburn is altogether the best of the foot-hill soils thus far examined, having a large supply of phosphoric acid, with plenty of lime, a fair supply of potash, and a high percentage of humus. The analysis shows good reason for the high estimate in which this region is held for the production of fruits, grapes, etc. The soil from the Lagrange foot-hills is not quite equal to it, but still it is a high-grade soil. That from near Merced Falls, No. 191, ranks somewhat lower, being very gravelly and having a smaller supply of both lime and phosphates, while the soil of the "hog-wallow" ridge, No. 196, ranks still lower, on account of a deficiency in potash. To the southward, in Fresno and Tulare counties, lime is again on the increase, as is indicated by the character of the valley soils and the occurrence of limestone in the foot-hills themselves; but no analyses of soils from these southern foot-hills have as yet been made.

It is thus evident that there are considerable differences and alternations in the character and value of the foot-hill lands, and that, while the greater portion is probably of fair to high quality, especially for fruit culture, there are tracts requiring manures from the very outset. Such can doubtless be recognized by an attentive observer from their vegetation. But my own observations, as well as the reports thus far received, are not sufficiently extended to determine what are the characteristic plants of each.

In view of the great uniformity of these soils to a depth of 15 inches or more, and their usually somewhat stiff character, deep and thorough tillage is indicated as of especial importance in their cultivation.

Soils of the foot-hill valleys.—As even the apparently uniform red soil of the foot-hills varies not inconsiderably, the same must be true to even a greater extent as regards the individual valleys within the region traversing belts of widely varying rocks. While it is true that the rivers of the Sierras most frequently emerge from the hilly country through narrow gorges or cañons, yet not inconsiderable areas of valley lands exist among the foot-hills. The following analyses were made originally with a view to a comparison between the original soil of a valley and the slum, or "slickens", that has overrun the same; but they are equally interesting as showing the wide divergence of the soil of individual valleys from the general average, whether of the foot-hills or the great valley itself:

No. 67. *Mining slum soil*, sent by Mr. J. Taylor, of Mount Pleasant, near Chinese Camp, Tuolumne county, December 16, 1877. The soil is a fine, cinnamon-colored sediment, deposited from the washings of the hydraulic gold mines of Chinese Camp and Montezuma. Some of the lumps in the soil were very hard to pulverize, yet most of them yielded to pressure between the fingers.

No. 68. *Valley adobe soil*, sent by Mr. J. Taylor, of Mount Pleasant, December, 1877. This is a black, clayey soil, now underlying the "mining slum" soil (No. 67) at a depth of 2 feet, and was quite fertile.

Soils of the foot-hill valleys, Tuolumne county.

	Mining slum soil.	Valley adobe soil.
	No. 67.	No. 68.
Insoluble residue	72.98	56.61
Potash	0.19	0.19
Soda	0.21	0.14
Lime	1.19	0.68
Magnesia	2.32	13.74
Brown oxide of manganese	0.08	0.08
Ferric oxide	9.30	18.43
Alumina	10.55	
Phosphoric acid	0.08	0.07
Sulphuric acid	0.03	0.01
Organic matter and water	4.43	9.84
Total	101.36	99.79
Humus	0.42	1.614
Available inorganic	0.36	0.395

The slum material is rather poor in the two most important ingredients of plant-food, potash and phosphoric acid, and it will probably be somewhat refractory in tillage for some time. In humus and available plant-food it is as yet naturally poor, but its redeeming feature, the large percentage of lime, will enable it to overcome this objection after having been covered with vegetable growth for some time.

No. 68 is a very remarkable soil in more than one point of view. On the whole, it is not dissimilar to the "slum" soil that has overrun it, and as regards the essential ingredients of plant-food it is no richer than the latter, except as regards the humus, and, consequently, the nitrogen and proportion of available plant-food. For the time being it would produce better than the slum soil, but ultimately both would be about equally durable, while neither takes a high rank in that respect. The unique feature of the adobe in this case is the extraordinary amount of magnesia, in which it exceeds all cultivable soils that have come under my notice heretofore. Both soils are probably derived substantially from the same original source, but the magnesian rock-powder has, in the case of the adobe, been so far decomposed by atmospheric action as to render its base soluble in the acid used in the analysis, while in the slum soil most of the magnesia has doubtless remained in the insoluble part.

A comparison of this "slickens" sediment with those previously discussed (pages 27–29) shows that there must be a very great difference in the agricultural value of the sediments coming from different valleys; for if the general sediment of the Sacramento river is so rich, despite the incoming of such materials as the one last described, the slum coming from some of the valleys must be of extraordinary richness, and a benefit to any lands covered by it to any moderate extent, when unaccompanied by the floods of gravel that render the richest materials practically useless for the purpose of the husbandman.

The sediment No. 67 now covers the original soil, No. 68, to a depth at which the latter is practically out of reach of the roots of crops.

THE SOUTHERN REGION.

The territory embraced in this division includes portions of the counties of Los Angeles, San Diego, and San Bernardino; in all a little more than 15,000 square miles.

The region subdivides naturally into a division embracing the Los Angeles and San Bernardino plains, the chief agricultural portion of southern California, and a division embracing the rolling hills, mesas, and interspersed valleys of San Diego. Both divisions are bordered eastward by the high and rugged mountains of the Sierra Madre, San Bernardino, and San Jacinto ranges.

The prominent feature of the southern region is the San Bernardino range of mountains, which, rising suddenly on the east to an elevation of from 4,000 to 6,000 feet above the sea, separates the coast belt from the great desert. From its junction with the Sierra Nevada mountains, in Kern county, it trends southeastward, and presently divides into two prongs, the northerly one continuing nearly to the Colorado river and gradually falling in elevation, the other, the San Jacinto range, bending southward, and, with a diminished height, passing out of the state into Mexico. This high range is almost altogether treeless and uninhabitable, has a width varying from a few miles to as much as 30 or 40 miles, and forms an almost unbroken barrier, with but few passes, between the great desert on the east and the agricultural valleys of the coast region.

To the westward of the range the mountains decline in altitude toward the coast, and are interspersed with many small valleys and mesa lands and penetrated to a distance of 75 miles eastward from the coast by the broad agricultural region known as the Los Angeles and San Bernardino plains. The higher mountains, those that lie near the San Bernardino range, are partly timbered with oak, cedar, pine, and fir, while the lower ranges are mostly bare, their lower slopes and cañons being covered with a chaparral. This division is watered by numerous streams flowing westward into the ocean, mostly without any great length. Of these the San Gabriel and Santa Ana rivers, in the Los Angeles plain, and the San Jacinto and San Diego rivers, in San Diego county, are the largest.

LOS ANGELES AND SAN BERNARDINO PLAINS.

The large agricultural region reaching inland from the coast, and bounded on the north by the high Sierra Madre or San Bernardino mountain range, on the west by the Sierra Santa Monica and others, and on the east (apart from the San Bernardino valley) by the Santa Ana mountains, covers an area of nearly 2,000 square miles. Its extent along the coast is about 65 miles, though broken by some mesa lands and hills. Northward it reaches about 35 miles across a chain of low hills to the mountains, whence it extends eastward for 40 miles in a belt of from 5 to 20 miles in width, forming the San Bernardino valley, and westward into the San Fernando valley, its entire length east and west being about 90 miles. It is divided properly into several large valley regions: the *San Fernando valley* on the northwest, separated from the coast and Los Angeles plain by the Santa Monica mountains; the *Los Angeles plain* proper, reaching along the coast from the latter mountains southeastward and inland to the high ranges, and including the San Gabriel valley; and the *San Bernardino valley*, forming the eastern extension alluded to, and separated from the coast on the south by the Santa Ana range of mountains.

San Fernando valley.—This valley covers an area of about 200 square miles, and has a length of 16 and a width of 12 miles, becoming very narrow on the east, where it opens through a gap into the Los Angeles plain. It is watered by the Los Angeles river, other streams from the mountains disappearing before reaching far into the valley. The surface is rolling, and on the north of the river there is a heavy growth of brush and cactus, the soil being very sandy. Along the river there are alluvial loams, while the lands of the rest of the valley embrace sandy loams, heavy on the northwest and light on the south, with alfilerilla, clover, sage-brush, some tar-weed, etc. Very little of its lands are under cultivation, the chief crop being small grain, with a yield of 30 bushels per acre.

Los Angeles plains.—It is usual to divide the Los Angeles region into a lower or coast plain and an upper plain, the former embracing a belt of low and "moist" land elevated from 5 to 80 feet above the sea, interspersed with low sandy ridges, and reaching inland for 15 or 20 miles. The coast-line of the county presents a series of low bluffs, sandy beaches, plains, and valleys on each side of the prominent headland that separates Santa Monica and San Pedro bays. The seaward slope is covered with a low and dense growth of sumac. The surface of the country rises inland, and is mostly undulating northward to the hills, where it becomes more broken, with low ridges and mesa or table-lands. Along the northern border of the plains the Sierra Madre mountain range breaks off precipitously on the south to a smooth, sloping plateau from 1 to 5 miles wide, which extends for a considerable distance along the base of the mountains through Los Angeles and San Bernardino counties. This plateau has a slope of from 100 to 300 feet per mile, and is evidently composed of the detritus washed down from the steep mountain slopes. From the Los Angeles river to the line separating the two counties the soil of this plateau is generally composed of red loam, compact and deep, containing considerable clay and fine gravel, while farther east gray granitic sand, gravel, and bowlders are the leading characteristics. In Los Angeles county this plateau in many places breaks off nearly vertically to a lower bench, along the rim of which large springs burst forth; but in general it slopes directly to the interior valley, with no perceptible division separating it from the valley proper. The country is without timber growth, except some willow, cottonwood, and sycamore along the streams, and sumac on the plains. The region is greatly diversified in its agricultural features and lands, the several varieties of sandy, gravelly, and clayey loams, both dark and red in color, occurring in irregular tracts, large and small, and gradually passing one into the other. The mesa or table-lands are chiefly red clayey loams, more or less gravelly, and usually occur near the mountain ranges, as well as in large bodies west and southeast of Compton, nearer the coast; they are said to be excellent grain as well as fruit lands. Throughout the rest of the valley dark loams, usually reddish, predominate. These loams are sandy, gravelly, and sometimes rocky near the hills and upon the higher tracts, while in the lower portions they are usually heavy, and often pass into the true adobe, a large body of which lies in the La Puente valley west of Spadra.

One of the most prominent features is the coast plain or "alkali lands" region, which occupies the greater part of the southern coast of the county. According to the records in the state engineer's office, this region extends from a few miles south of Los Angeles south to the coast, and southeast along the shore nearly to San Diego county, with a width of from 6 to 8 miles. The surface is partly flat, partly rising into low sandy ridges, between which lie the valleys or swales of alkali lands proper. The soil is usually a mouse-colored or somewhat bluish fine loam, sparkling with small scales of mica; it has little vegetation beyond the "alkali grass" (*Brizopyrum*), and the low portions do not produce well unless special means are adopted to counteract the effects of the alkali. This lower plain is the corn-growing region of this part of the state, its moist lands needing no irrigation and producing large crops.

There are a number of other tracts of alkali land in the higher portions of the county, notably on the San Gabriel river, east of Los Angeles, and on the north of the Santa Ana mountains.

San Bernardino valley.—On the north is the San Bernardino range of mountains, having an altitude of from 5,000 to 7,000 feet; on the east a low range of clay hills, having for their summit the divide of the San Gorgonio pass; on the south a low range of clay and granite hills; and on the west a high mesa, forming the west bank of Lytle creek. The surface of the valley presents a gently undulating or level plain, gradually rising toward the hills from the Santa Ana river, and in places is studded with trees. The soil is a gray gravelly loam, rather stiff in the center of the valley, becoming more and more sandy as the hills are approached. That at Riverside and on other plateaus or mesas is red and clayey in character and of great depth. These lands are said to produce as much as 35 bushels of wheat per acre, and are pre-eminently adapted to fruit-growing.

THE SAN DIEGO REGION.

Until quite lately all but the coast of San Diego county was difficult of access and little known to the general public. No systematic or even somewhat full description of the interior region has thus far been given in any publication, and what follows is compiled from many sources and cursory statements not always agreeing with each other. The country south of the Los Angeles plains is, along the coast through San Diego county, rolling and somewhat broken, interspersed with mesa lands and valleys, and is almost entirely treeless, comparatively little of it being suitable for cultivation. Inland the surface becomes more and more broken and hilly for about 30 miles to the low mountain belt that, with an elevation of about 3,000 feet, lies to westward of the high San Jacinto range. This

mountain d.vision is about 40 miles in width, though varying very greatly, and is a continuation southward of the Santa Ana mountains. It contains extensive tracts of good farming lands in the valley-like table-lands that are inclosed between the main mountain ridges and is said to be the best agricultural portion of San Diego county. Wheat, barley, oranges, grapes, etc., are among the products. Along the San Diego river there are narrow valleys that are among the best farming tracts of the county. Of these Cajon valley is perhaps the most noted, and may be taken as a type of the others. It is about 20 miles east of the city of San Diego, and, as its name indicates, has the appearance of a great basin 6 miles long and 4 miles wide, walled in on every side by mountains, and reached with difficulty, from which the San Diego river escapes through a narrow cañon. The surface of this valley is comparatively level and treeless, except along the river, where there is a growth of cottonwood, sycamore, and willow. The soil is a sandy, gravelly loam, largely under cultivation.

A descriptive pamphlet issued by the San Diego chamber of commerce says of the county:

The following is the picture presented to nine-tenths of the visitors who approach this county by way of the coast: Hard, gravelly table-lands, either barren or clad with a dreary black brush; rolling hills of gravel, bristling with cactus and cobble-stones; stony slopes, scarred with gullies and washes; no trees, no streams, no springs; the general barrenness relieved only by a few choice little valleys and a few tracts of good table-land. Looking inland, the visitor sees only swell after swell of bare hills looming through a dreamy haze and terminating in a high range of dark blue mountains on the east. The farming land, however, lies scattered in a thousand shapes all over a tract about 100 miles long and 70 wide, the greater part miles away from the coast, and visible only after many days' travel. Beginning at a point along the southern line of the county some 25 or 30 miles from the coast, and running back to the crest of the mountains bordering the desert, thence north to Temecula, is a belt upon which the rainfall is nearly always double, often triple, that of the country along the lower coast. Along this belt lie Valle de las Viejas, Cuyamaca rancho, the Julean hills and valleys, the Santa Ysabel, Mesa Grande, Warner's rancho, Guejito, Bear valley, Pauma, Smith's mountain, and smaller valleys too numerous to mention, with some large tracts along its edge partaking somewhat of its general nature, such as the Santa Maria, San Bernardo, Rincon del Diablo, etc. Upon the main part of this belt crops are as absolute a certainty as in any part of the east, and though subject to many of the causes that shorten crops in the east, such as unfavorable weather for "stooling" or "filling", etc., they never suffer from drought. All through this section fruit is raised in perfection without a particle of irrigation. * * * The average altitude of this belt is about 3,000 feet, and it covers about one-third of the country west of the desert.

Near Temecula this belt divides, one branch running off toward the high mountains on the east, the other bending off to the west, leaving the great plains of Temecula and San Jacinto, with all their rich lands, subject to the general uncertainty of the rainfall of all southern California. These plains often have as heavy a rainfall as the above-mentioned belt, but, as about once in three years they fall short, they cannot be included within it. The eastern branch of this rain-belt runs into a country in which bare, rugged, and dreary hills are the general rule, though there are a few fine little spots, such as Oak Grove, Bladen, and Aguanga, and some large valleys like the Coahuila.

A section of this western rain-belt, embracing Fall Brook, the greater part of Santa Margarita and Santa Rosa, running all the way to the coast at Las Flores and Forster City, and really including within its limits the Vallecito de Temecula, Monserrate, and the whole San Luis River valley above Monserrate, along with Paimousa and mount Fairview, has less rain than the main belt, but in the driest years the precipitation has never fallen below 7½ inches.

Fully three-fourths of the arable land in the county is alluvial, either washed from the ancient streams or lakes or from the hills, and free from rock or clay immediately below the surface; and on three-fourths of the rest the rock or hard-pan is too far below the surface to do any injury. The adobe, or California clay soil, one of the richest and strongest in the world, but one that requires much water at just the right times, is here comparatively rare, most of the soil being alluvial and very loose.

Timber is abundant throughout the river bottoms and in the mountains, willow, cottonwood, and sycamore prevailing on the former.

Soils of the southern region.

The lands of the inland valleys and mesas are characterized mostly by soils containing a large amount of gravel and coarse sand of a brownish or reddish tint. They are commonly distinguished into lands of the first bench, or bottom lands of the streams; lands of the second bench, forming either at the present time or originally a system of terraces elevated from 15 to 25 feet above the bottom lands, and still readily irrigable from the headwaters of the streams; and, finally, the mesa lands, lying at higher elevations and with no definite relation to the present drainage system, and not ordinarily conveniently irrigable from the streams, but dependent upon sources of supply lying high up in the cañons. Of course these distinctions are not absolutely maintainable, the second benches and lower mesa lands passing into each other imperceptibly, especially on the upper portions of the streams, while again, in the lower portions of the same, the second bench lands often lie high enough to be classed as mesas. On the slopes of the mesa lands the soil of the latter and that of the bench lands are frequently commingled.

It is to be regretted that none of the important soils of the "cienegas" have as yet even reached the collection of the College of Agriculture. Of those of the coast, only a few samples from the swales impregnated with alkali have been received, and these have been examined in respect to alkali only, as hereafter noted. The reddish-gray soils of the San Bernardino valley are represented in the table of analyses on page 40 by the soil and subsoil from the neighborhood of Pomona.

No. 130. *Surface soil* of the second bench of the San Gabriel valley, Los Angeles county, taken from Alhambra ranch, near San Gabriel, December, 1877, by Mr. J. De Barth Shorb. "A fair sample of the heavier class of soils in the San Gabriel valley." Color, dun or brownish gray, showing at once a good deal of small gravel and coarse sand. This soil lies higher than that on which the older orange orchards of the valley are planted, but the tree seems to thrive equally well on it when given sufficient moisture.

Nos. 382 and 381. *Soil and subsoil* from Pomona colony, Los Angeles county; taken respectively to the depths of 12 inches and from 12 to 32 inches. The soil and subsoil scarcely differ in appearance, and are a reddish-gray, rather sandy loam, easily tilled; natural vegetation, alfilerilla, clover and malva (*M. borealis*), and some "rattleweed" (*Astragalus Menziesii*); produces about 25 bushels of wheat and 10 tons of alfalfa hay per acre when irrigated, and is well adapted to cereals and fruits.

No. 47. *Surface soil of mesa land*, such as forms the larger part of the arable land in the southern part of San Diego county. This analysis was taken by Mr. F. A. Kimball, of National ranch, San Diego county, who thus describes it:

> The change of tint from surface soil to subsoil occurs at depths varying from 11 to 25 inches, and the sample sent represents the average from widely separate places, but with the same kind of soil. The underlying subsoil varies in thickness from 2 to 10 feet or more, is very retentive, and is of a clayey nature.
>
> The orange, lemon, and olive seem better adapted to this "red mesa" soil than to the best valley soils of the San Diego, Sweetwater, Otay, or Tia Juana rivers, a larger growth and earlier fruiting being invariable on the mesa. All the northern fruits, except perhaps the cherry and plum, are produced on it in the greatest perfection, the flavor of the apple and peach exceeding any I have tasted in northern California or in the east.

The soil is of a light reddish-brown tint, rather coherent, and apparently somewhat heavier in working than soil No. 130, which it otherwise greatly resembles, containing, likewise, a considerable amount of visible gravel.

No. 506. *Bottom soil* from the Colorado river between El Rio and Yuma stations, San Diego county; a silty, pulverulent soil of a light buff tint, dry lumps but little coherent, changes color but little in wetting, but becomes slightly plastic, showing some clay to be present. Unchanged to the depth of several feet; samples taken to 12 inches depth. This soil bears a heavy growth of mesquite trees, in low places arrow-weed, and on the Arizona side a great deal of creosote plant (*Larrea Mexicana*). Cultivation has not as yet been attempted here, but has been very successful lower down.

Soils of the southern region.

	Los Angeles county.			San Diego county.	
	Soil of San Gabriel valley.	Pomona colony.		Soil of mesa land.	Bottom soil, Colorado river.
		Low mesa soil.	Subsoil.		
	No. 130.	No. 382.	No. 381.	No. 47.	No. 506.
Insoluble matter	81.12	72.519	75.304	86.21	58.574
Soluble silica		5.121 / 77.640	3.872 / 79.176		5.327 / 63.901
Potash	0.27	0.839	0.962	0.48	1.177
Soda	0.17	0.296	0.301	0.14	0.162
Lime	0.68	2.354	2.052	0.36	8.671
Magnesia	1.77	2.225	2.154	0.54	2.986
Brown oxide of manganese	0.10	0.039	0.043	0.10	0.025
Peroxide of iron	6.30	8.097	7.342	3.69	4.139
Alumina	6.79	5.974	5.835	5.12	8.379
Phosphoric acid	0.16	0.018	0.049	0.23	0.133
Sulphuric acid	0.07	0.022	0.020	0.03	0.145
Carbonic acid					7.818
Water and organic matter	3.07	2.550	2.546	2.60	3.344
Total	100.50	100.054	100.480	99.50	100.800
Humus		0.324		0.555	0.752
Available inorganic		0.263		1.439	1.151
Available phosphoric acid					0.133
Hygroscopic moisture	2.30	3.460	2.370	2.340	9.204
absorbed at	15 C.°	15 C.°	15 C.°	15 C.°	15 C.°

While the first bench or bottom lands were the first cultivated and rendered highly productive by irrigation, the second bench lands seem to be scarcely inferior to the former for fruit production, at least, when properly irrigated. No. 130 was selected as a representative soil of this kind. Its potash percentage is rather low, but it has a good supply of phosphoric acid and lime, and its easy tillage and great depth, offsetting its somewhat low retentiveness of moisture, render it a very desirable soil. It is to be regretted that no analyses of mesa soil from the Los Angeles region are as yet available for comparison.

The *Pomona soil* may, judging from the great similarity of appearance, be taken as representative of a large area of similar lands in the San Bernardino valley. The soil and subsoil are a good deal alike in composition.

Both have a large supply of potash and lime, as well as magnesia, and both are poor in phosphoric acid, the soil even being remarkably deficient, and the supply apparently increasing with the depth. The supply of humus is very small, and its increase seems to be among the first needs of the soil. It must not be forgotten, however, that the surface soil in these dry regions is really of less importance than the subsoil, in which the roots must remain in order to be secure from the drought and heat. Evidently such land, while capable of high yields at first, will soon need phosphate fertilizers for continued productiveness.

The *mesa soil* from San Diego is of excellent composition in all respects but that of being somewhat deficient in humus, a fault easily remedied in cultivation. It is richer in both potash and phosphoric acid than the Los Angeles soil, but its smaller proportion of lime detracts somewhat from its advantage over the other. Considering its great depth and its large supply of plant-food, it is certainly of high promise, and would amply repay any reasonable expense incurred in its irrigation. Where convenient, this soil, especially where it is of the heavier kind, would be benefited by a moderate application of lime or marl.

The soil of the Colorado river bottom is certainly a highly productive one, easily worked, and not liable in case of overflows to suffer from wet, being quite light, notwithstanding its large percentage of alumina shown by analysis. It is a highly calcareous soil, containing, as it does, over 16 per cent. of carbonate of lime, partly in concretions, but mostly in a finely pulverulent form. Its potash percentage is very high; yet there seems to be no trouble from alkali, as the soda percentage is quite small. Its supply of phosphoric acid is fair, though not large for a bottom soil; the humus percentage is likewise small for a lowland soil, yet adequate. It is therefore likely that whenever the water of the Colorado river shall be made available for irrigation these bottom lands will yield rich returns for cultivation. It is worthy of remark that in this case the whole percentage of phosphoric acid is extracted with the humus, showing that it is entirely in the available form.

Alkali soils of the Coast belt.—The level or gently undulating region lying adjacent to the coast, as before mentioned, possesses a dark-tinted loam soil, characterized by a large proportion of glistening mica scales. The higher portions of these lands are free from excess of soluble salts, but the lower lands or "swales" intervening, and running usually down to the sea-shore, show more or less "alkali", and will not grow some crops at all on that account. Three samples of soil of this character have been sent for examination, with the results given below:

Salty soil from the coast flat between Anaheim and the shore, sent by Mr. Charles D. Ellis, of Anaheim; said to be fairly representative of the above tract, which is flat, and appears to be underlaid by brackish water at a depth varying from 4 to 6 feet. In low spots it is often covered with a white crust, and seeds fail to germinate there. The soil is a dark-colored sandy and micaceous loam, with a well-marked saline taste. Qualitative analysis showed simply the ingredients of sea-water. There is therefore no antidote or remedy but those usually applied to coast marshes, and the term "alkali" is improperly applied in this case.

Alkali soil from near Corvallis, Los Angeles county, sent by Mr. S. G. Baker, secretary, on behalf of "New River Grange", December 6, 1876. This soil is reported as occurring in streaks over a considerable district. "Nothing seems to grow on it except salt grass. Common mallows and corn will vegetate on it, but not mature. Fruit trees rot at the roots, and willows at the bark. Beets seem to thrive when irrigated, but when not irrigated grow very small, though much sweeter than when irrigated. It appears to be the earliest of our soils to get dry. I have subsoiled it 2 feet deep with little benefit. * * * A small patch, highly manured with cow manure, has been greatly improved. Another small patch, coated 4 inches deep with sand, will grow good corn." Brackish water is found at the depth of 10 feet, and a plentiful supply of good artesian water at 450 feet. "In most cases the land lies well for drainage."

The soil as received is of a mouse color; a light, sandy loam, glistening with particles of mica (as seems to be very generally the case in that region). It yielded to water 1.62 per cent. of saline matter, which, in 100 parts, consisted of—

	Per cent.
Chloride of sodium (common salt)	22.37
Sulphate of sodium (Glauber's salt)	51.19
Carbonate of sodium (sal soda)	17.48
Sulphate of potassium	8.74
Phosphate of calcium (bone phosphate)	0.51
Total	100.29

The amount of soluble salts in this case is very high, but probably represents the worst of its kind, taken from near the surface. The neutralization of the sodic carbonate by means of gypsum would doubtless afford partial relief at once.

Alkali soil from Westminster colony, Los Angeles county, sent in April, 1877, by Mr. W. G. McPherson, as chairman of a committee on alkali soils appointed by Westminster grange. A dark gray, rather sandy soil, glistening with particles of mica scattered throughout the mass. The letter accompanying this sample makes the following statements in regard to it: "This soil is taken from Westminster, Los Angeles county, about 5 miles from the ocean, and near the center of a tract of about 30,000 acres now occupied by farmers; and there is no farm of forty acres but has some of this kind of soil, or something similar. * * * The sample sent is of medium strength, varying from it both weaker and stronger. * * * It is a little too strong for barley, but beets will grow on it under favorable circumstances. The subsoil is apparently the same, only growing looser (sandier) downward to the depth of from 4 to 10 feet, where tough blue clay is met with. Above this blue clay is permanent water (faintly brackish), and below it, at a depth varying from 60 to 200 feet, is a bountiful supply of pure artesian water. Now, if you can give us a remedy that will render this soil available, you will be conferring a benefit upon a large number of people."

The partial analysis of this soil resulted as follows:

Soluble salts in the soil, 0.54 per cent. These salts were composed, in 100 parts, of—

	Per cent.
Chloride of sodium (common salt)	10.57
Carbonate of sodium (sal soda)	61.48
Sulphate of potassium	20.62
Carbonate of potassium (saleratus)	6.59
Total	99.26

The high percentage of carbonate of soda in this alkali explains the energetic action of so small a percentage in the soil. It was recommended that a dressing of 900 pounds of land plaster per acre should be given before rains or irrigation. The following report is eloquent as to the results:

I took one-tenth of an acre of the same soil from which the sample came, irrigated it, then sowed 65 pounds of plaster, then plowed 6 inches deep and sowed 35 pounds more, then harrowed and planted with corn. Where the water stood on top of the ground there is a good stand of corn, although, being the lowest ground, it was the strongest in alkali; but where the land was only sub-irrigated not more than half of the corn came up. I replanted, and only half of that came up. The first planting is about a foot high and growing vigorously, and has a good color. I think the failure on the drier part was caused by there not being sufficient water to bring the alkali in contact with the gypsum. This crop subsequently ripened well; and since then much experience of the same character has been had. Of course the presence of water to enable the chemical reaction to occur is absolutely essential. The duration of the effect of a single application will, of course, vary under different circumstances, and especially according to the nearness of the water-table to the surface.

HYDROGRAPHY.—In view of the fact that the availability of the agricultural lands of the region is entirely dependent upon its topography and hydrography, a separate discussion of these, taken from the report of the state engineer for 1878–'79, is here introduced:

The higher interior mountain range is drained by three principal streams, which break through the Coast or Santa Ana range with independent outlets to the sea; *i. e.*, the Los Angeles, the San Gabriel, and the Santa Ana rivers. These are fed by numerous tributaries, which join them before reaching the Coast range, but in their further course to the sea they receive no important accessions to their volume. During the rainy season these streams and their tributaries are dangerous torrents, sweeping down from the mountains in which they rise in large volume and with great velocity, carrying a mass of bowlders and gravel far out into the valley. They subside as quickly as they rise, and during the summer would dwindle to nothing, but that their supply is maintained by springs which appear in their beds from hidden sources.

The Los Angeles river traverses the San Fernando valley, emerging through a gap terminating the Santa Monica range, to the city; below the city the river bed is broad, shallow, and sandy, and only upon rare occasions does the water find its way entirely through to the sea, but is absorbed by the thirsty sands. The streams that empty into the San Fernando valley from the Sierra Madre have a very rapid fall, and, on reaching the valley, spread out into broad washes, whose beds are composed of bowlders, gravel, and coarse sand. In flood they flow entirely across the valley to the Los Angeles river, but in summer the water barely emerges from the mountains and sinks from sight in the porous channels. The lands irrigated from this river are confined chiefly to the vicinity of Los Angeles city.

The water of San Gabriel river, except in flood, is seldom more than sufficient to fill the two irrigating ditches of the upper district, which head directly at the mouth of the cañon and divert all the available supply, leaving the broad rocky bed of the stream entirely dry for 10 or 12 miles, when the water begins to reappear in the channel a short distance below the bridge of the Southern Pacific railroad. At this point the river has two distinct and diverging channels from 1 to 5 miles apart, having independent outlets to the sea. In each of these channels there are numerous springs, the water rising at a number of points along their course, forced to the surface by the impervious substratum of clay underlying the whole valley at a depth of a few feet. From these springs is derived the supply for the elaborate system of ditches in the low San Gabriel valley.

The Santa Ana river emerges from the mountains through a wild and precipitous cañon over a bed of loose bowlders, in which the greater portion of its volume is lost before reaching the valley. A few miles lower down the water begins to rise, but is diverted by an irrigating ditch, leaving a dry bed for 4 miles to the mouth of Warm creek, where the river receives a fresh supply from the *cienegas* (*a*) of San Bernardino basin. Thence to the Coast range the bottom lands are saturated with a succession of *cienegas*, which drain into the river. Between the Coast range and the sea the river supplies water to several large canals which head near the hills, the river itself spreading out into a broad bed of quicksand over 1,000 feet wide.

The *cienegas* of these two valley regions are an important feature with reference to their system of irrigation. They often cover many acres of land each, and have a thin layer of peat or moss, sometimes several feet thick, over the bed of gravel. This peat prevents the free flow of its waters, and blind-drains and artesian wells have been resorted to in order to increase the supply of the latter.

The supply furnished by these springs is much more constant and reliable than that of the natural surface streams, and, at a time when irrigation is most needed, is probably greater than that from any other source. In the series of springs which appear along the rim of the plateau between Arroyo Seco and San Gabriel river, furnishing water for the irrigation of the far-famed orange groves and vineyards of the "San Gabriel fruit belt", there are no less than 18 distinct *cienegas* in a distance of 8 miles, each covering from 1 to 40 acres of ground and supplying water for irrigating from 20 to 400 acres each.

In the center of the city of Los Angeles, on each side of the river, on the lower bottoms, are *cienegas* which afford considerable water, the supply apparently coming in from other sources than the percolation from the stream. West of the city, at the foot of the low hills, next the sea-coast, there are large *cienegas* covering several hundred acres, from which issues Bellona creek. Near Pomona there is quite a large *cienega*, which supplies water for 440 acres; total volume, about 3 cubic feet per second. The *cienegas* of San Bernardino basin are the largest of any in the southern country, and furnish the greater portion of the summer supply of the Santa Ana river. The two principal ones are near the town of San Bernardino, and cover an area of over 300 acres each. Opposite Riverside, in the bottom lands of the river, are other large *cienegas*, adding from 25 to 30 cubic feet per second to the volume of the stream.

The streams and *cienegas* are so inseparable that it is impossible to estimate the duty done by each. In the coast valley there are many large *cienegas*, which, aside from those of Bellona creek and the San Gabriel river, are not used for irrigation.

Artesian wells.—The third great source of water supply for irrigation is derived from artesian wells. The greatest artesian belt in all southern California is that running through the coast valley of Los Angeles, having a length of 40 miles and a width, as at present explored, of from 2 to 12 miles, the total area being about 300 square miles. The rivers mentioned cross the belt on their way to the sea, and the fact that the wells having the strongest flow are adjacent to the channels of these streams seems to indicate that the water supplying these wells is that which has disappeared from the streams above and percolated between impervious substrata at an elevation sufficient to give the head or pressure by which it is forced again to the surface through the outlets furnished by the perforations. The depth of the wells is from 50 to 550 feet, the usual depth being from 150 to 200 feet. The number of wells in the belt is over 500, and the greatest discharge is about 1.7 cubic feet per second; some of them irrigate from 100 to 200 acres each, though a well that will irrigate 40 acres is considered a good one. It is found that as the number of wells is increased the flow of all is diminished, showing that the supply is comparatively limited. Some of the wells on the higher land have since gone dry or ceased to flow; others flow only in spring time. Another natural effect has

a Cienega is a Spanish term locally applied to a swampy or boggy ground caused by the rising of subterranean waters to the surface. The word *cienega* always implies a spring and the marsh or moist land surrounding it, for which it is almost exclusively used in this section of country.

been noticed in some parts, that, since the boring of so many wells, the level of the surface water in the adjacent country above has gradually lowered; some of the *cienegas* on higher levels have also diminished in their flow. Flowing wells have also been obtained in other localities north of Los Angeles, and in the upper San Gabriel valley as well as in the San Bernardino basin. The depth at Pomona is about 160 feet, and the temperature of the water is 67°, winter and summer alike, while that of other wells in this southern region is but 62° F. A singular fact in connection with the Pomona wells is that by capping or uncapping any one of them the flow of the others is increased or diminished with regular pulsation.

In the San Bernardino basin artesian wells are bored rather for domestic use and small garden irrigation than for general agricultural purposes. The area in which flowing wells have been obtained, as at present defined, is confined to about 30 square miles, within which are the large *cienegas* and sources of Warm creek.

The natural gate, outlet, or drainage of the valley is in its southernmost portion, where the Santa Ana river passes between two hills of limestone, or rather what was once apparently one hill, since cut through. At this point the "bed-rock" is near the surface, forming the valley of San Bernardino into a complete and large catchment basin for the water-shed of a very large area of country, the main channel of drainage being the Santa Ana river. The soil of the valley, as far as pierced by artesian borings, shows it to be mainly granitic in character, stratified by alternate layers of clay, evidently swept in from the country east and south. Borings to a depth of 150 and 200 feet frequently pierce a bed of vegetable mold, proving that the valley has been filled up by gradual erosion of the surrounding hills. The estimated number of wells is from 400 to 425, and their diameter from 2 to 8 inches, that of the greater number being 2 inches. The shallowest wells are 80 feet, the deepest flowing wells 380 feet, the average being about 160 feet. The deepest well in the valley is 410 feet, and has a diameter of 7 inches. Vegetable matter, consisting of decayed tule roots and pine wood, was brought up from the last 60 feet.

THE DESERT REGION.

The area included in the desert region is nearly 35,000 square miles, embracing the largest part of Inyo, the southeastern and northeastern corners of Kern and Los Angeles counties respectively, all of San Bernardino except the southwestern corner, and nearly all of the eastern half of San Diego county.

This desert, known as the Colorado desert or basin, reaches far eastward into Arizona. On the west it abuts against the foot of the high Sierras, and on the south against that of the San Bernardino range of mountains, both rising thousands of feet above it. The larger part of its surface, as a plateau skirting the foot of the mountains, lies at an elevation of 2,000 feet above the sea, and is comparatively level, though broken frequently by isolated short ranges and peaks rising a thousand feet or less above it. In its center there is a large area which is not more than 1,000 feet above the sea, and in Inyo county a still smaller region, known as Death's valley, sinks to some hundreds of feet below the sea. Coahuila valley, or that portion of the desert included between the two prongs of the mountain range on the south, is mostly below 1,000 feet in elevation, a large portion sinking below the sea, Dry lake, near Dos Palmas station, on the Southern Pacific railroad, being said to be some 500 feet below this level. There are scarcely any streams through the desert, except along its border, where they flow from the adjoining mountains and soon disappear in the sands. Mojave river, which gives its name to the northern desert region, is the largest stream, but after flowing from the San Bernardino mountains for a short distance out into the desert it suddenly disappears. The desert is described as a sandy barren waste, interspersed with salt lakes and alkali tracts, destitute of all timber growth except occasional tracts of yucca, small nut pines, and juniper. It is, especially on the south, subject to very frequent and severe sand-storms, which not only cover the lands of the region with deep and shifting deposits of sand, but often blow through the passes, and, with their lighter sands, greatly annoy the people of the agricultural valleys on the west side of the mountains.

A few miles southwest from Dos Palmas there is a broad valley, bounded by ranges of hills of hard-baked red clay, called the Chocolate and Coyote mountains; and in this valley is the dry bed of a lake 40 miles in circumference, which is nearly 60 feet below the level of the sea. This great basin is separated from the dry beds of a number of creeks which appear to have once been connected with it by a level plain about 5 miles wide. Nearly in the center of this plain there is a lake of boiling mud, about half a mile in length by about 500 yards in width. In this curious caldron the thick grayish mud is constantly in motion, hissing and bubbling, with jets of boiling water and clouds of sulphurous vapor and steam bursting through the tenacious mud and rising high in the air, with reports often heard a considerable distance. The whole district around the lake appears to be underlaid with this mud, as it trembles under foot and subterranean noises are heard in all directions. Hot springs and sulphur deposits are numerous for many miles around this lake.—*Natural Wealth of California.*

DEATH'S VALLEY.—The following is taken from Cronise's *Natural Wealth of California:*

This valley, according to observations made by a party of the United States boundary commission in 1861, is sunk 400 feet below the level of the sea, while but 70 miles west of it are clustered a number of the highest peaks of the Sierra Nevada, many of which are from 12,000 to 15,000 feet in height. For 45 miles in length and 15 miles in width along its center it is a salt marsh with a thin layer of soil covering an unknown depth of soft gray mud, a large portion of the basin being covered with an incrustation of salt and soda several inches thick. The surface is usually so soft that a man cannot travel over it in winter without difficulty, it being impossible for animals at any season to cross it. With the exception of a few clumps of worthless shrubs near its borders, this plain is destitute of even the slightest traces of vegetation. The valley is encircled by a barren sage plain from 3 to 6 miles wide, which, beginning at the base of the mountains that surround it on every side but the south, slopes gently to its margin. A few mesquite trees grow among the sands at the head. The heat of the valley is fearful during the summer, ranging from 110 to 140 degrees during the day. When there is no breeze through the long cañon the air becomes so oppressive that respiration is painful and difficult. At a point about 30 miles north of Death's valley the Amargosa river, a stream of small volume but great length, takes its rise, and, flowing southeast for more than 100 miles, makes a detour when far out on the Mojave desert, and, bending round to the northwest, runs in that direction about 40 miles, when, having reached the southern end of this arid plain, it finally disappears.

Soils of the Mojave desert.—Ascending the mountains from Kern valley near Bakersfield through the Tehachapi pass, we emerge upon the western part of Mojave desert, a plain-like basin surrounded by mountains and more or less traversed by rocky ridges. In crossing this basin by rail during the dry season the traveler is generally impressed with the idea of hopeless aridity, which is scarcely relieved by the only tree-growth visible from time to time, viz, the yucca (here commonly but erroneously named "cactus"), whose awkward branches, terminated by tufts of rigid, lance-shaped leaves, impart rather a weird aspect to the landscape, and seem as uninviting to the agricultural prospector as the clouds of dust and sand that whirl about the train. But while it is true that there are some portions of this region whose deep sand beds seem to consign it to the true "desert land" class, there are other and very extensive tracts, having a soil of considerable native fertility, whose powers only need the life-giving agency of water to transform the desert into luxuriant fields and gardens. That this is so has repeatedly been shown by actual experiment at points where water was available. This is not at present the case at the railroad station of Mojave; hence the quality of the soil has not been tested by actual trial, but its appearance indicates a substantial nature where it is not covered by sand drifts. It seems to be directly derived from the surrounding mountains, along the base of which such soils seem to form a kind of marginal bench.

No. 332. *Surface soil* of the Mojave desert, taken near Mojave station, Kern county, by N. J. Willson, of the Central Pacific railroad, to the depth of 12 inches. A moderately heavy, dun-colored loam, with little coarse sand, containing siliceous and other rock fragments; slightly effervescent with acid, somewhat "sticky" when wet, and its color little changed. It would evidently till quite readily, but no cultivation has been attempted thus far. The vegetation is sage-brush, creosote plant, and a little grass.

Soil from Mojave desert, Kern county.

	No. 332.	
Insoluble matter	70.965	75.964
Soluble silica	4.999	
Potash		0.928
Soda		0.078
Lime		1.787
Magnesia		1.782
Brown oxide of manganese		0.026
Peroxide of iron		5.478
Alumina		9.227
Phosphoric acid		0.056
Sulphuric acid		0.012
Carbonic acid		0.456
Water and organic matter		3.903
Total		99.697
Humus		0.283
Available inorganic		0.370
Hygroscopic moisture		10.759
absorbed at		15 C.°

The analysis of this soil shows clearly that it is not inferior in productive capacity to some of the soils of the great valley, which it greatly resembles, save in the scarcity of humus or vegetable matter. Its supply of lime and potash is high, while that of phosphoric acid is low, but not more so than in some very productive soils of the valley. The scarcity of humus is the defect which it would be most needful to remedy, and this probably is best remedied by turning in a crop of alfalfa, which there could be no difficulty in growing where irrigation is available. There are doubtless many tracts where even this defect does not exist, since they are covered with a dense growth of small shrubs, under which grasses flourish in good seasons, giving pasture to sheep. Irrigation is here the all-important question, since the natural rainfall of about four inches, sometimes reduced to one or two, cannot be relied upon for any purpose. Only a detailed survey, however, can determine the tracts having an arable soil as against those overrun by arid sand.

THE COAST RANGE REGION.

The country lying between the great valley and the sea-coast is, on the whole, a mountainous one, traversed by many more or less disconnected ranges, usually trending parallel to or at a small angle with the coast. From Mendocino county, inclusive, southward to the northern end of the San Bernardino range, few points or crests exceed the height of 4,000 feet, and most of the higher ranges remain between 3,000 and 3,500 feet. Many of these are very rugged and barren and largely treeless. Of the lower ranges up to 2,000 and even 2,500 feet many are rounded in outline, deeply covered with soil, and, in the moister portions of the region, susceptible of cultivation to their summits. These in most cases are at the present time occupied only as grazing grounds, the bulk of cultivated lands lying in the numerous valleys interspersed between the ranges and on the lower slopes.

THE BAY COUNTRY.—A somewhat detailed description can alone convey a good idea of the various sections of the Coast range; but there is one prominent feature requiring notice at the outset, viz, the break caused by the drainage outlets of the great valley, Suisun bay, Carquines straits, and the bays of San Pablo and San Francisco, with their final outlet through the "Golden Gate". This "bay region" constitutes a climatic as well as a hydrographic and a topographic feature; for, insignificant as the break formed by the Golden Gate may seem, it modifies profoundly the climate of the country lying adjacent and opposite to it, not only by the influence of its cool tide-water, but as well by the correspondingly cool lower air-currents sweeping through it almost throughout the season, and carrying with them both the temperature and the moisture of the ocean, both modified by the cold Alaskan current. In summer the river of fog, a mile wide and from 600 to 1,500 feet high, may be seen flowing in steadily through the Gate in the afternoon, first submerging the city of San Francisco, and then broadening and sending off branches right and left up and down the bay, and toward evening reaching the opposite shore, where the Contra Costa range forms a barrier for a time. Eventually this is surmounted, and finally the cloudy ocean may reach as far as Mount Diablo, where it dissolves before the dry air of the great valley. The direct influence of this current extends about 10 miles each way on the opposite shore, causing an exceptionally low summer temperature, which fails to ripen the grape and the fig. On the western shore of the bay the ranges of the immediate coast form a barrier not surmounted by a considerable proportion of the summer fogs, under the lee of which a warmer summer temperature prevails on the bay-shore slopes of the counties of San Mateo and Marin, as well as on both shores of the southern portion of San Francisco bay toward San José. The cold currents strike across San Pablo bay into the lower part of Napa and Sonoma valleys, but are chiefly deflected so as to form a steady and sometimes hard "blow" through the straits of Carquines, beyond which they enter the great valley and form, as before stated, the regular "up-valley" winds of that region.

The features of the immediate bay country are in many respects so peculiar that, although in the subdivisions according to rainfall (given on page 12) it is conjoined with a portion of the coast region lying northward and southward, continuity of description renders it desirable to consider the rest of the Coast range in divisions lying north and south of the bay country proper.

The western shores of the bays near San Francisco, and around San Pablo bay to Petaluma creek, are rather abrupt, with but little valley land lying back of it in the broken country, in which mount Tamalpais forms the highest point and falls off southward to the "north head" of the Golden Gate. Around the outlets of Petaluma, Sonoma, and Napa creeks there is a considerable tract of marsh or "tule" land, but Mare island and Carquines straits fall off into rocky precipices, and on the Contra Costa shore the railroad winds laboriously along the base of low but rugged escarpments until it reaches the lower end of San Pablo bay. Here, back of the bold promontory that narrows the passage into San Francisco bay, begins the sloping plain and in part the marsh belt that skirts the eastern bay shore from San Pablo to San José, forming, with the corresponding plain lying south of San Francisco on the western shore, an important and thickly populated agricultural region. Opposite San Francisco this slope is about 3 miles wide, falling about 300 feet from the foot of the Contra Costa hills. Southward it widens to 7 or 8 miles on either shore, a tide-marsh belt of varying width skirting the bay shore, and the two belts, finally uniting at the lower end of the bay, form the broad and fertile Santa Clara valley, so noted for its charming climate and the production of fruit and wines. Here the summer fogs, having to surmount the high coast mountains, are much diminished both in frequency and in coolness, and the vine, fig, and almond attain great perfection.

The soils of this bay coast are substantially of three kinds. Immediately along the shore lies a narrow strip of sandy land, sometimes sand drifts, which influence more or less the character of the adjacent marshes; most of the soils of the latter, however, are heavy, and when reclaimed are very productive. Inland of these lies a broad belt of black, calcareous, and very fertile adobe or prairie soil, somewhat refractory in tillage, which toward the foot of the hills often becomes yellow and relatively poor. This adobe belt is interrupted by the sediment lands of the streams flowing from the Coast range to the bay, which are generally light and often of considerable width, although few of these streams are now of much importance, but the frequent shifting of their channels in past times has increased the alluvial surface. These sediment lands, frequently, of course, passing gradually into the adobe proper, are noted for their productiveness, and furnish much of the market supplies of the two cities in fruits and vegetables, but are more especially noted for the high quality of brewing (Chevalier) barley produced on them. Sugar-beets likewise succeed well, but cotton fails to mature its bolls within reach of the coast fogs.

The range skirting the eastern shore, commonly known as the Contra Costa range, though traversed by some abrupt cañons, has largely rounded crests and summits and gentle slopes with deep and in part very productive soils, now largely used for grazing purposes only, but susceptible of cultivation to the top. Extensive plantations of eucalyptus trees are beginning to be made on this range, and succeed admirably. They originally had some redwood timber, and have now in the cañons and on the northern and eastern slopes not inconsiderable bodies of live oak (*Q. agrifolia*), madroña (*Arbutus Menziesii*), laurel (*Umbelularia Californica*), and buckeye (*Æsculus Californica*); on the banks of streams the Western alder (*Alnus incana*) and maple (*Acer macrophyllum*), the buckthorn (*Frangula Californica*), with more or less undergrowth of hazel, poison-oak, bramble, and others, and much eagle fern (*Pteris aquilina*).

Thermal belts.—Among the climatic peculiarities belonging more or less to the whole state, but more especially pronounced in the valleys opening toward the bay, is the occurrence of "thermal belts", or minor regions exempt to a remarkable degree from the severe frosts of winter, but more especially from the later ones of spring, which are so dangerous to fruit about the time of bloom. These usually occur between 100 and 800 feet above the valleys, varying of course with the trend and exposure to the coast winds. The difference in temperature at sunrise between these belts and the valleys sometimes amounts to as much as 10° F., which, in a region where the thermometer rarely falls below 26°, of course implies a very material difference in the chances of such fruits as almonds, apricots, and even the vine, and in many cases permits of the successful culture of semi-tropical fruits, such as the orange, lemon, pomegranate, etc. Thus the latter are successfully grown, *e. g.*, in certain valleys near Martinez, Contra Costa county, within 2 miles of the cold blast that sweeps through Carquines strait. Similar cases are frequent in the valleys of Napa and Sonoma, a striking example being that of the Vacaville fruit belt, in Solano county. In the Santa Clara valley the culture of the almond follows narrowly a similar warm belt.

COAST REGION SOUTH OF THE BAY COUNTRY.

That part of the coast region lying south of San Pablo bay to the southern region has an average width of about 60 miles, and covers an area of about 18,350 square miles. Lying between the coast and the great valley region on the east, it embraces within its limits the entire counties of Contra Costa, Alameda, San Francisco, San Mateo, Santa Clara, Santa Cruz, San Benito, Monterey, San Luis Obispo, Santa Barbara, and Ventura, and the western portions of Stanislaus, Merced, Fresno, Tulare, and Kern.

The surface of the entire region is mountainous and hilly, and is bordered on the east by a continuous range having an average elevation of about 3,000 feet above the sea, the highest probably of the region, reaching from Suisun bay southeastward through the state, and forming a long and rather wide barrier between the great valley on the east and the somewhat lower mountains and valleys of the central and western portions of the region. Westward from this range, which is often known as the Mount Diablo range, from the prominent peak of that name on the northern extremity, lie other mountain ranges of nearly or quite the same altitude, forming the appearance of long offshoots toward the northwest, each having a distinct name, and sinking on either side into the lower ranges before reaching the coast. The trend of the mountain ranges is thus usually northwest and southeast, and the courses of the rivers that drain the valleys between the mountains are northwestward into the ocean, except in the extreme south, in Santa Barbara and Ventura counties, where their course is mostly westward. These ranges are mostly destitute of trees, except scattered bodies of chaparral and sometimes other growth, and are partly too high and rocky for cultivation, being chiefly used for grazing purposes. The Contra Costa range, the first of the minor ranges (though not so high as the others) on the extreme north, abuts against the shore line of San Pablo bay, and, reaching southwestward, separates San Ramon and Livermore valleys from the "plain of Alameda", which borders the bay of San Francisco on the west. The range is broken by deep ravines and cañons, and is nearly treeless on the west and south slopes (except in the cañons, where there are clumps of oak, laurel, madrone, etc.), while on the east and north there is an abundance of live and white oaks, maple, etc. This range properly includes the higher Mount Diablo range on the east, with which it unites south of Livermore valley. Mount Diablo itself is an isolated peak, rising 3,896 feet above the sea, its summit rounded and its slopes nearly treeless, except in the ravines, where there is found a varied growth, with chaparral of scrubby oaks in the higher region.

The next ranges of note on the south are the Gavilan and the Santa Cruz ranges, apparently originally continuous, but now cut in two by the Pajaro river. The Gavilan range reaches northwestward from the southern part of San Benito county, separating that county from Monterey on the west, while the Santa Cruz range separates Santa Clara county from Santa Cruz and San Mateo. Both ranges rise to elevations of 3,000 feet, and are in part too high for any purpose except that of stock-raising. The Gavilan mountains are partly timbered with pine, except in the highest portions, which are rough, broken, and mostly destitute of trees. The Santa Cruz mountains are mostly heavily timbered with redwood and oaks, the redwood forest occupying a not inconsiderable area on the seaward side of the mountains, reaching in available masses as far north as Redwood City, many of the trees attaining a height of 200 feet or more. Scattered redwoods also originally dotted the ranges around and opposite San Francisco, but oaks alone now remain. On the east of the range is Santa Clara valley, and on the west are the Pajaro and the Salinas valleys, the most important as well as the largest of the region. Lying still further south is the Santa Lucia range of mountains, the most extensive of the offshoots, reaching from the main range, in the southeastern part of San Luis Obispo county, northwestward through Monterey to the coast. Its average width is about 30 miles, rising almost throughout its length into central elevations of 3,000 feet and more. The mountains are in places heavily timbered on their lower slopes and in the cañons with Monterey pine, cypress, and redwood.

Between this range and that bordering the San Joaquin valley are the high valley lands of the upper Salinas river and its tributaries, reaching northwest into Monterey county, and opening out through narrow defiles into the broad Salinas valley proper. On the west of the Santa Lucia range the high hills reach either abruptly to or within a short distance of the coast, the small streams usually accompanied with valleys of greater or less width. Still southward, at the junction of the Sierra Nevada mountains with the Coast range, we find a broad and extensive region of high mountains, the Sierra San Rafael, in the eastern part of Santa Barbara and northern part of Ventura

counties, merging on the southeast into the San Bernardino range. The mountains are here cut into by the narrow Soledad pass (through which the Southern Pacific railroad has found a road-bed), which connects the Mojave desert with the cañons of the headwaters of the Santa Clara river, flowing westward to the ocean, the pass and the river valley thus forming a convenient east and west line of separation between the southern region and the Coast range division.

Near the coast, in the southern part of Santa Barbara county, and extending eastward from point Concepcion, there is a small but rugged range (the Sierra Santa Inez) from 2,000 to 3,000 feet in altitude, its trend nearly coinciding with that of the Sierra Nevada where it joins the Coast range.

THE COAST.—The coast line presents a very irregular contour, often deeply indented with bays, and throughout its length rises, usually quite abruptly, from the water's edge to elevations of 1,000 feet and more, the rocky prominences frequently projecting far out into the ocean. Its chief indentations are the bays of Monterey, Santa Monica, and San Pedro.

The general direction of the coast line is southeast in a direct line for a little more than 200 miles, thence southward for 100 miles to point Concepcion, the weather divide of the southern Coast region, where it suddenly strikes due eastward almost at right angles for more than 100 miles, finally rounding back to its southeast course to the limit of the state.

The rugged and hilly character of the coast is only occasionally relieved to any extent by level and tillable lands, except where the larger streams, especially the Salinas and the Santa Clara, have found their way to the ocean, producing broad areas of delta or alluvial land with the sediment brought down from the mountains.

The lands suitable for cultivation, and comprising, too, the only populous portions of the region, are the valleys that lie between the mountain ranges and skirt the streams, and also the foot-hills and lower ridges that are not too broken and rocky. From the coast these valleys rise in elevation and become more and more narrow to the cañons of the higher mountain ranges, through which their rivers have cut their way, and beyond which there are frequently other and higher mountain valleys of greater or smaller extent.

On the north of point Concepcion the river valleys have a trend southeastward from their outlet, while in the region of point Concepcion and southward the trend is eastward from the coast.

A description of the coast region is best given by taking the valleys consecutively. Beginning at the north, the first in order are—

SAN RAMON AND LIVERMORE VALLEYS.—San Ramon valley, lying between the Contra Costa range on the west and the Mount Diablo range on the east, opens northward into Suisun bay, and with a width of about 6 miles reaches south for 15 miles, where it becomes very narrow, finally opening out into the extensive Livermore basin or valley in Alameda county. The valley is dotted with scattered oaks, and its soil is largely a stiff adobe, in many places exceedingly black and waxy, which yields under cultivation about 30 bushels of wheat per acre. The soils around the base of Mount Diablo are partly reddish and partly gray, often gravelly loams. The valley is watered by streams flowing northward into the bay, and a number of small valleys connect with it on either side. Livermore valley, on the south, is about 14 miles long east and west, from 5 to 8 miles wide, and is surrounded by rolling foot-hills and mountains, from which other valleys open into it. The north and east part of its surface is a plain, the south and west part a region of rolling hills, and all is dotted over with oak trees and watered by numerous streams, timbered with sycamore, and tributary to Alameda creek, which flows westward into the bay of San Francisco through a cañon in the Coast range. The soil of the valley plain is dun-colored, with a pale yellow loam subsoil, often gravelly, more especially near the water-courses, the beds of which in summer appear filled with gravel only, although water is mostly found beneath. The soil of the rolling lands is mainly a red, often clayey loam, which also forms the subsoil where the surface soil is dark colored.

SANTA CLARA VALLEY.—This valley, with its adjoining foot-hills, is one of the most important agricultural districts within the limits of the Coast Range region. Its entire length is about 70 miles through Santa Clara into San Benito county, and its width at the bay of San Francisco, where it connects with the Alameda plain on the one side and that of San Mateo on the other, is about 20 miles. Eleven miles south of San José this valley suddenly narrows to about 100 yards, but again opens out to several miles until the Pajaro river is reached, whose valley westward is a connecting link with that of the Salinas river, in Monterey county. From the Pajaro southward for several miles beyond Hollister the width is about 12 miles, and the valley terminates or rises to a rolling plateau or bench land, which reaches across it, and is known as Poverty hill or Hollister valley. Still southward the valley region becomes more and more narrow and elevated, and is rarely over half a mile wide.

This Poverty Hill region is treeless, and its soil is an adobe, covered in the depressions of its surface with a silty loam, and underlaid at about 4 feet with a clay that is more or less alkaline in character. The lands between Hollister valley and the Pajaro river are partly adobe and partly a sandy loam.

In the broad valley north of this, in Santa Clara county, the surface is undulating, with low, rounded hills, and is dotted with clumps of oak. The land of the lower or northern portion near the bay is mostly black and stiff adobe, with some salt or marsh lands in the region of Alviso, near the bay. The higher lands of the valley are a lighter sandy loam, gravelly on the east and west, while those of the hills on either side are a cinnamon-colored loam, with a reddish-brown subsoil, well adapted to grape and fruit culture.

The area of the valley is almost all improved, and most of it is under cultivation. The crops comprise wheat, barley, corn, potatoes, and vegetables, and the yield of the black lands is said to be from 35 to 40 bushels of wheat per acre. Dairying is also carried on to a large extent. Grape and fruit-growing, including also figs, olives, and almonds, forms the prominent pursuit in the neighborhood of San José. The almond in particular succeeds in many favored localities of the "thermal belt" of the mountain sides that is protected from the direct impact of the coast winds and is sufficiently elevated above the valley to escape passing frosts.

The climate of the valley, as compared with that of San Francisco, is greatly tempered by the intervention of the Coast range between it and the sea, rendering summer fogs much less common, and thus permitting the ripening of many fruits that cannot be successfully grown nearer the Golden Gate. The same causes render the milder and warmer climate of the Santa Clara valley a health resort from the harsher atmosphere of San Francisco.

Cotton culture has not been fairly tested, but it is not, on the whole, likely to be successful so nearly within reach of the coast winds.

SALINAS VALLEY.—Reaching southeastward from Monterey bay for 90 miles, with a width of from 8 to 12 miles for the first 50 miles, is the Salinas valley. This valley is watered by the river of the same name, and inland becomes very narrow, rising rapidly in elevation to the mountain cañons in the southern part of the county, and through them connecting with the mountain valleys in the central part of San Luis Obispo county, in which the river takes its rise. The surface of the lower valley presents a terraced and almost treeless plain, the only growth being some live oaks on the northeast and sycamore along the river. The alluvial bottom lands are from one-fourth to one-half a mile wide, and are bordered by a somewhat higher terrace of adobe bottoms from 1 to 2½ miles in width. West of Salinas city there is a large tract of hog-wallow lands, embracing also a number of small tule lakes. The Salinas river flows mostly on the west side of the valley, a region of mesa lands lying between it and the Santa Lucia mountains still to the westward.

On the eastern side of the valley the adobe bottom lands are bordered by a sharply-defined terrace 11 feet higher, rising gently against the Gavilan mountain range. The surface of this terrace is rather rolling, and its soils are coarse, red, and gravelly, affording excellent farming lands where protected against the high winds that sweep in from the ocean every day during the year, and against which a person is said to be scarcely able to stand at times, the stock taking refuge in the thickets along the river. The valley is therefore chiefly used for stock-raising, very little farming being done. The higher connecting valleys on either side have mostly dark loam or adobe soils, and are partly under cultivation.

On the north, after passing a region of low, sandy, and treeless hills, the valley is connected with Santa Clara valley by the Pajaro valley, a heavy grain-growing region, which borders the river of the same name, reaching eastward from the coast. This valley is from 6 to 8 miles wide and its surface quite level, and embraces three varieties of soils: *dark loam lands* of the plains, adapted to wheat and barley; *adobe lands*, comprising one-third of the river bottoms, and lying several feet below the plains; *clayey loams* of the bottoms, known as the sugar-beet region. The valley is bounded on either side by a range of smoothly-rounded hills, those on the south being mostly too broken for cultivation. The small valleys between these hills are mostly swampy, with either tule or willow, and often hold small lakes or ponds of water.

The mountain valley region of San Luis Obispo county is watered by the Salinas river and other smaller streams, and presents a series of low, rolling hills, with intermediate valleys having separate names. The Salinas valley is, however, the chief one of this region, and is about 9 miles wide, with an elevation of about 1,000 feet above the sea. On the southeast it rises into a level plateau some 300 feet above the valley proper, and soon terminates; its lands are mostly adobe. There is but little timber. The bottom soil along the streams is chiefly a dark loam, while that of the upland or valley is mostly a stiff clay loam, usually reddish, more or less gravelly, easily tilled, and interspersed with some adobe tracts. This entire valley region is principally a stock range, though some of its lands are under cultivation. Paso Robles springs, a noted health resort, is situated in the northern part of the valley in a plain of about 10 square miles, and is surrounded by a grove of live oaks.

OTHER VALLEYS.—Along the coast in this county there is a series of valleys and plains which are separated from the immediate coast line by a chain of hills and watered by streams which are lined with cottonwood, sycamore, laurel, and live oaks. Their soils embrace the dark loams of the bottoms and the dark sandy or reddish loams of the valleys resting on heavy clays. The soil of the hills is lighter and gravelly.

Still southward the valleys of the Santa Maria and Santa Inez rivers are respectively about 10 and 2 miles wide and 30 long, each reaching the coast through narrow cañons, and having a greatest width about 15 miles inland. The Santa Inez valley was originally timbered with oaks. Its surface presents a series of terraces of 25, 45, and 95 feet, respectively, above the river.

The Coast region east of point Concepcion embraces two valleys or terraces, an upper and lower, varying in width from 2 to 6 miles. The immediate coast line forms at first a terrace about 80 feet high, sinking at Santa Barbara and eastward to the Ventura line to a lower level. The upper valley, known as the Santa Barbara plain, is about 300 feet above the sea. The soils of these coast valleys, both on the east and north of point Concepcion, are sandy loams, while those of the higher altitudes are largely adobe in character.

In Ventura county the Santa Clara and Buenaventura rivers are also bordered by narrow valleys, that of the latter river being about 30 miles long by about one-fourth of a mile wide and having sandy soils. The Santa Clara valley, which is sandy and very narrow from its source to Santa Paula, then widens gradually, until within 12 miles of the coast it suddenly expands into the Saticoy plain, widening to about 16 miles on reaching the coast, from the town of San Buenaventura on the north to that of Hueneme on the south. The northern portion of this fine agricultural region is largely an undulating upland with a yellowish loam soil; the southern constitutes a kind of delta of the Santa Clara river, its soil near the latter being a dark gray silty loam of great depth and fertility (see analysis below), remarkable for its retention of moisture near the surface, and noted for its high production of corn and beans, as well as its special adaptation, inland, to the European walnut. The mountain valleys have mostly adobe soils, and those whose altitude is less than 2,000 feet are partly under wheat culture. Of these the Ojai is the most important. Its lower portion has a dun-colored loam soil, timbered with white oak and very productive; but from this there is a sudden ascent of 500 feet or more to the upper valley, the soil of which is mostly a rich black adobe, producing enormous crops of wheat.

CHARACTER OF SOILS.—The characteristic reddish gravelly soils of the southern region extend to the sea-shore near Santa Monica and southward wherever there is a bluff bank, while where the surface descends more gently there are, as in the Westminster and Anaheim region, coast flats several miles in width, in which the soil is a dark-colored sandy loam, glistening with scales of mica, and more or less affected with alkali in the lower portions. Similar soils, in tracts of greater or less extent, are found up the coast as far as Santa Barbara at least. None of these soils have as yet been analyzed, except with respect to the alkali salts sometimes present in them, which at times are purely saline, at others strongly alkaline, from the presence of carbonate of soda. (See "Alkali soils of the southern region", page 41.) As a rule, these sea-shore lands are very productive.

The valleys of the seaward slope of the Coast range have mostly gray, light, and silty, rather than sandy soils, and are quite similar in appearance from Ventura to Humboldt county, though differing considerably in composition, those of the southern region being more calcareous, and apparently richer in phosphoric acid. Among the best agricultural valleys in this division is that of the Santa Clara river, in Ventura county, which opens out into the fertile plain of Saticoy. No soil samples from the latter have been received, but the following represent fairly the soil of the valley near Santa Paula:

No. 168. *Valley soil*, taken from Mr. N. B. Blanchard's orange orchard near Santa Paula, Ventura county. The color of this soil is a light umber, and when wet blackish and silty, very easily tilled, and retains its tilth remarkably, so that the hand can easily work its way into it up to the elbow and an ax-handle can be thrust down to the head with little exertion. The material remains apparently the same for from 12 to 20 feet in the lower bench of the valley, where this sample was taken. Toward the hills there is a second bench, where the soil is apparently the same, but of a slightly reddish tint. On the mountain slopes the soil, still quite similar in its working qualities, is of a decidedly reddish tint, and is remarkable for its retention of natural moisture, enabling it to produce corn without irrigation.

No. 182. *Reddish mountain soil* from Mr. N. B. Blanchard's land, near Santa Paula, taken to 12 inches depth.

No. 170. *Subsoil of second bench land* on Colonel W. Hollister's ranch, near Santa Barbara. (See page 50.) This specimen was examined, not as a fair sample of land, but with a view to detecting the cause of the dying-out of orchard trees some years after coming into bearing that occurs in streaks both here and elsewhere in the Santa Barbara region. The surface soil is dark gray or blackish, several feet in depth at most points, but where the dying-out occurs is underlaid by a whitish, sandy hard-pan, with pale rusty spots, indicating imperviousness and bad drainage. The spots are, however, known as having "poison soil", the trouble being ascribed to some injurious substance contained in it. The analysis shows no cause for any injury in the chemical composition of this subsoil, which is very fair in every respect, showing a high percentage of phosphoric acid, potash, and lime, and even, somewhat unexpectedly, of active humus. The cause of the difficulty is doubtless a mechanical one, the tree roots after a certain time reaching an impervious layer, waterlogging their roots in winter and leaving them unable to seek moisture in the depths of the soil in summer. Deep subsoiling, breaking up the hard-pan layer, seems to be the only possible remedy.

Soils of the Coast range south of the bay country.

	VENTURA COUNTY.		SANTA BARBARA COUNTY.
	Silty soil, lower bench, near Santa Paula.	Mountain soil (reddish), near Santa Paula.	Hillside subsoil ("poison soil"), Hollister's ranch.
	No. 168.	No. 182.	No. 170.
Insoluble matter	85.664 } 87.511	74.930 } 82.842	83.065 } 87.743
Soluble silica	1.847 }	7.912 }	4.678 }
Potash	0.634	0.621	0.506
Soda	0.070	0.164	0.068
Lime	0.759	0.952	0.561
Magnesia	0.598	0.955	0.666
Brown oxide of manganese	0.025	0.036	0.055
Peroxide of iron	3.350	5.070	3.116
Alumina	3.095	5.939	2.995
Phosphoric acid	0.200	0.127	0.223
Sulphuric acid	0.003	0.039	0.094
Water and organic matter	3.132	2.669	3.854
Total	99.372	99.414	99.871
Humus	0.843	1.055	1.341
Available inorganic	0.368	1.004	0.271
Available phosphoric acid	0.200	.....	.....
Hygroscopic moisture absorbed at	5.488 15 C.°	6.590 15 C.°	5.980 15 C.°

Both soils from Ventura county show an excellent composition, the valley soil having the advantage of a high percentage of phosphates, while the mountain soil, a little heavier, with a smaller amount of phosphates, has a higher lime percentage and more humus. These soils are especially interesting, as being peculiarly favored in regard to their relations to moisture. No. 168 remains moist within from 15 to 20 inches of the surface during the driest part of the season, when the water table falls as low as 20 feet below the surface soils. The same is true more or less of the Saticoy plain at large; and the soil of other valleys, as, *e. g.*, the Ojai, is measurably similar. So are probably the valley soils of Santa Barbara, so far as I have had the opportunity of examination.

The first two of the following soils are from the Salinas Valley région:

No. 606. *Upland soil* from Poverty hill, San Benito county, collected by Mr. H. Partsch for the United States census; taken to the depth of 12 inches. This soil is of a dun color, somewhat silty, the dry lumps being easily crushed by fingers; softens readily in water, the color darkening but little; is easily tilled, apparently not adhesive, and produces moderate crops in good seasons, but is unthrifty and risky. This kind of land lies in the depressions of a kind of bench across the eastern head of the Santa Clara valley, while the higher portions are formed of a gray adobe, which also forms the subsoil of the loam lands at varying depths.

No. 600. *Loam upland soil* from Soquel ranch, Santa Cruz county, collected by Mr. H. Partsch. This is a reddish umber-colored loam when dry, the lumps crushing easily between the fingers, and softening quickly on wetting. It is very easily tilled, and contains some coarse sand. This sample represents the soils of the upland terrace which abuts upon the seashore southward of Santa Cruz.

No. 37. *Valley soil* from a small valley between Pescadero and Benton creek, about 200 feet above sea-level and two and a half miles away from the shore, sent by Pescadero grange, and selected by Messrs. Osgood, Burch, Weeks, and Thompson, committee. This soil is a brownish black loam, somewhat hard when dry, but softening easily on being wet, and taking almost a black tint; it produces good potatoes, barley, and oats. The product of potatoes has fallen, by cultivation, from 28,000 to 12,500 pounds; the cereals not so much. Deep tillage and thorough pulverization is found to be very beneficial in dry years. The timber in the valleys is redwood, oak, and alder, with buckeye, madrone, and pine on the uplands.

Valley lands of the Coast region.

	SAN BENITO COUNTY.	SANTA CRUZ COUNTY.	SAN MATEO COUNTY.
	Upland soil, "Poverty hill."	Loam upland soil, Soquel.	Valley soil near Pescadero.
	No. 606.	No. 600.	No. 37.
Insoluble matter	85.596	80.426	78.084
Soluble silica	2.567 } 88.163	3.028 } 83.454	3.237 } 81.321
Potash	0.333	0.343	0.541
Soda	0.109	0.126	0.231
Lime	0.676	0.502	0.925
Magnesia	0.526	0.390	0.820
Brown oxide of manganese	0.048	0.014	0.039
Peroxide of iron	2.856	3.928	4.934
Alumina	4.214	5.711	4.821
Phosphoric acid	0.027	0.053	0.084
Sulphuric acid	6.015	0.009	0.027
Water and organic matter	3.476	4.955	6.757
Total	100.443	99.485	100.500
Humus	0.819	1.463	2.850
Available inorganic	0.284	0.579	0.625
Hygroscopic moisture	5.218	5.602	7.387
absorbed at	12.5 C.°	15 C.°	15 C.°

Nos. 600 and 606, while still of the same general physical character as those of Ventura and Santa Barbara, differ chemically by their smaller percentage of potash and phosphoric acid, the latter being very decidedly deficient in the "Poverty Hill" soil. Their lime supply is still, however, quite adequate for thriftiness in such light soils, which, like those farther south, show a very satisfactory and remarkably uniform power for absorbing moisture, viz, from about 5½ to 6½ per cent. It is evident that here, as in the San Joaquin valley, the phosphates will be the first thing requiring replacement when these soils become "tired", and fruit rather than grain culture should be pursued by those cultivating them. It is not, of course, certain that these soils represent the character of the Salinas region correctly.

The valley soil (No. 37) from near Pescadero, San Mateo county, shows it to be of a somewhat higher grade than the above, and approaching more nearly in character the soils of Ventura, above described. It shows a high lime percentage, a large one of potash, and a considerably higher amount of phosphoric acid than the Santa Cruz soils, though yet rather low, being only half of that contained in the valley soils of Ventura and Santa Barbara. While sufficient for present thriftiness, in the presence of so much lime it is pretty certain to need phosphates so soon as its first fertility is exhausted, especially where dairying is the chief industry. The humus percentage is remarkably high for so light a soil within the coast region. It probably represents fairly the favorite soil of the redwood.

While on the seaward slope of the Santa Cruz range there is an evident predominance of light loam soils, the landward portion of that range seems to possess large tracts of heavy red-clay soils, whose character, of course, influences more or less that of the valley soils derived therefrom, especially in Santa Clara county. On the mountain slopes these lands are largely covered with "chaparral" (*Ceanothus*) and other scrub growth. The following is the analysis of a sample sent by Mr. William Pfeifer from a tract lying two miles northeast of Saratoga:

No. 702. *Chaparral soil* from Saratoga, Santa Clara county. Dark reddish brown when dry, forming hard lumps; dark umber color when wet, and softening easily; quite stiff in working, but assuming good tilth when taken at the right stage of moisture. Sample taken to the depth of 12 inches, below which lies a gravelly, rather stiff clay subsoil of an orange tint. More or less angular fragments of the country rock (a fine, soft, calcareous sandstone or shale) are contained in both.

Chaparral land, Santa Clara county.

	No. 702.	
Insoluble matter	57.449	62.563
Soluble silica	5.114	
Potash		0.859
Soda		0.260
Lime		1.987
Magnesia		2.428
Brown oxide of manganese		0.096
Peroxide of iron		10.619
Alumina		9.516
Phosphoric acid		0.139
Sulphuric acid		0.063
Water and organic matter		11.921
Total		99.853
Humus		3.096
Available inorganic		0.884
Hygroscopic moisture		12.090
absorbed at		15 C.°

This analysis gives high testimony to the intrinsic value of the soil. It has an abundant supply of potash, as well as of lime, even for such a heavy soil. Its phosphoric acid percentage is fair, and its supply of humus is somewhat extraordinary for a soil formed in an "arid" climate. Its power for absorbing moisture is very high, from the concurrence of the large humus supply with that of iron oxide (ferric hydrate). It is therefore a soil of great resources, and is well deserving of the high culture which its peculiar mechanical condition necessitates. It must be kept thoroughly and deeply tilled, and its somewhat refractory subsoil should be broken up, so as to allow deep penetration to the roots. Not being irrigable, on account of its location, its best adaptation would seem to be to the growing of sweet grapes for the table, for raisins, or heavy wines. A very similar soil is found in some of the vineyards near Mission San José, and under high cultivation has yielded excellent results.

The soils of the San Francisco peninsula are derived from two distinct sources, viz, the disintegration of the country rocks and the sand drifting in from the seashore on the west. The latter originally covered the larger part of the present site of the city, and is still continually invading its rear, giving great trouble in and around Golden Gate park, where the efforts to subdue it have been measurably successful by the aid of grasses, shrubbery, and herbaceous plants adapted to the circumstances. Where the sand is excluded by protecting ridges the soil is mostly a somewhat stiffish one, formed from the clayey shales and sandstones, which are here and there replaced by serpentinous rocks. The latter influence the soils but little save as diluents.

The following analyses of soils from the Presidio reservation were made at the request of the United States military authorities, through Major W. A. Jones, of the engineer corps:

The *surface soil*, No. 680, is dark-tinted, varying in depth from 4 to 12 inches, according to location, and is moderately heavy. The *subsoil*, No. 682, is yellow and clayey, with a good deal of coarse sand, and contains abundant fragments of the soft, somewhat calcareous, sandstone from which it has been formed.

710

Sandstone land, Presidio, San Francisco.

	Soil.	Subsoil.
	No. 680.	No. 682
Insoluble matter	78.135	70.224
Soluble silica	3.458	5.532
	81.593	75.756
Potash	0.675	0.590
Soda	0.080	0.172
Lime	0.846	0.399
Magnesia	0.780	1.221
Brown oxide of manganese	0.053	0.059
Peroxide of iron	5.682	7.268
Alumina	5.162	9.737
Phosphoric acid	0.031	0.011
Sulphuric acid	0.053	0.022
Water and organic matter	5.404	4.900
Total	100.359	100.135
Humus	2.284	
Available inorganic	1.045	
Hygroscopic moisture	6.023	9.411
absorbed at	15 C.°	

This soil shows a good supply of plant-food, with the exception of phosphoric acid, in which it is very deficient, its subsoil having scarcely more than what might be called a trace. Its high percentages of potash, lime, and humus make it an excellent subject for effectual improvement by the use of phosphate manures, which are manufactured in the city of San Francisco, but thus far have found little sale. The soil overlying the serpentines differs from these merely in a higher percentage of insoluble matter and magnesia.

The Mount Diablo range from San Pablo and Suisun bays to San José has mostly heavy "adobe" soils on its flanks and in the smaller valleys, as well as on its eastern foot, in the San Joaquin valley, and the heavy grain crops produced even to the very summits of the ridges in good seasons testify to the fertility of these somewhat refractory soils, whose productiveness varies sensibly in accordance with the amount of lime present in them; and this, again, can in a measure be judged of by the more or less dark tint of the soil. Limited deposits of impure limestone occur with frequency among the clayey and siliceous shales of the range, in which calcite or carbonate of lime commonly fills the rock crevices. Where this is not the case, we occasionally have tracts of heavy clay soils of tawny tint, cold and refractory, and often ill-drained, with the siliceous, shaly bed-rock a few feet beneath the surface, and such, unfortunately, happens to be the character of a large part of the university experimental grounds, while in the valleys lies an excellent black adobe soil, derived from the higher portions of the range. The following analyses show the composition of these soils:

Nos. 1 and 2. *Black adobe soil and subsoil*, taken on the state university campus, Alameda county, in the rear of cottages 3 and 4, half way to the bridge. The black soil here is over 30 inches deep, underlaid by a yellow, stony subsoil. It becomes exceedingly "sticky" when wet, but plows easily when taken just at the right point of moisture; when plowed a little too wet it clods heavily, but the clods tend to pulverize in drying. With shallow tillage, or when left untilled, it forms widely gaping cracks in the dry season; but if tilled deeply and thoroughly it retains moisture and a luxuriant growth of weeds throughout the dry season, and is almost ashy in its tilth. The soil having been sown in grain, so far as known, for many years and worn badly, it was deemed best not to take the surface soil for analysis, but a layer from 12 to 22 inches depth, and then another from 22 to 30 inches, the latter representing the extreme probable range of crop roots. The results of the analyses of both of these layers are given in the table on page 54.

No. 4. *Ridge adobe subsoil*, taken from the crest of the ridge on the agricultural grounds of the university, in the orchard, from the depth of 10 to that of 20 inches. Tint, a tawny yellow; very heavy in working, difficult to till at all times, and remaining wet until late in the spring. At a depth varying from 2½ to 5 feet it gradually passes into "rotten" shaly clay sandstones, fragments of which are everywhere intermixed with the soil. The tract is ill-drained, even on the ridge, and is esteemed a poor soil.

No. 643. *Black waxy adobe soil* from the Colton ranch, at the foot of Mount Diablo, Contra Costa county. Very black when wet, grayish when dry; when wet, excessively adhesive, so as to cling in masses to wagon-wheels, requiring to be scraped off from time to time. Vegetation, scattering white-oak trees (*Q. lobata*) and sunflower (*Helianthus Californicus*), but little else.

Adobe soils.

	Alameda county.			Contra Costa county.
	Agricultural grounds, Berkeley.			Colton ranch.
	Black adobe.		Ridge adobe.	Black waxy adobe.
	Soil.	Subsoil.	Subsoil.	Soil.
	No. 1.	No. 2.	No. 4.	No. 643.
Insoluble residue	77.844	69.563	86.002	50.960
Soluble silica				9.020
				59.980
Potash	0.452	0.348	0.189	0.192
Soda	0.074	0.109	0.154	0.741
Lime	1.050	0.998	0.484	2.471
Magnesia	1.211	1.913	0.452	0.890
Brown oxide of manganese	0.078	0.093	0.038	0.065
Ferric oxide	4.675	7.208	4.013	11.090
Alumina	7.788	13.970	5.532	15.689
Phosphoric acid	0.231	0.116	0.057	0.057
Sulphuric acid	0.077	0.028	0.021	0.045
Organic matter and water	5.718	6.600	4.051	8.304
Total	99.198	100.946	100.993	99.524
Humus	1.750	.....	.....	1.500
Available phosphoric acid	.....	.....	.....	0.036
Available inorganic	.....	.....	.....	0.829
Hygroscopic moisture	7.36	.....	.....	13.510
absorbed at	15 C.°	.....	.....	15 C.°

The obvious similarity of the black adobe, Nos. 1 and 2, to the "black prairie" of Mississippi and Alabama is abundantly confirmed by these analyses. Both in mechanical and chemical composition the adobe is so nearly like the "white lime prairie" soil of Mississippi that the differences are scarcely greater than might be found in different localities in either region. The prominent features are the high percentages of clay and the finest sediments, the influence of which in rendering the soil heavy in working is offset by a large supply of lime and black humus. The supply of potash is fair, and that of phosphoric acid large, being one-third above that of the Mississippi prairie soils. This explains the fact that grain crops, so exhaustive of lime, have for a succession of years been grown on California soil without apparent diminution. The subsoil below twenty-two inches seems to decrease gradually in the supply of plant-food. The sample analyzed probably represents pretty correctly the black adobe soils of the Coast Range slope from San Pablo to Mission San José.

The differences in the mechanical (*a*) and the chemical composition of this ridge adobe as compared with that of the valley is sufficiently striking. It contains less than two-thirds the amount of clay, yet it is much heavier in working, owing to the small quantities of the finer sediments, which chiefly serve to break up the extreme tenacity of pure clay, that is but little disturbed by the large-sized grains. Then the soil contains less than half as much lime as the lowland adobe, less than half also of the primarily important ingredients, potash and phosphoric acid, and, finally, a mere trace of vegetable matter, or humus, as is shown both by its tint and by the smallness of the "organic matter and water" item.

The unproductiveness of this soil is clearly owing to two causes combined. It is naturally poor in plant-food, and its mechanical composition makes it so refractory that it is only in exceptionally favorable seasons that what it does contain of plant-food can remain available to plants, since, in drying, it becomes of stony hardness, with only cracks to aid the circulation and penetration of air and roots.

This is one of the cases in which improvement by merely supplying the plant-food would be a waste of money unless the physical condition be corrected at the same time. Underdrainage would probably do this most effectually; green manuring would also be a very important aid; but the unusually small amount of clay for so heavy a soil promises excellent results from the use of a moderate quantity of quicklime or marl, and the fertilizer experiments made on the university grounds have fully sustained this inference.

Locally, we often find the heavier soils of the Coast range so modified by the admixture of gravel and sand derived from irregularly distributed geological deposits of this character as to render them easily tilled and specially adapted to the culture of barley and fruit. This is more or less the case along the streams on the borders of San

a See table of mechanical analyses on pages 83, 84.

Francisco bay, but especially so in Livermore valley, that remarkable basin inclosed between two branches of the Coast range, with apparently an ancient outlet through the San Ramon valley toward Suisun bay. Near Pleasanton the Coast Range hills are flanked and even capped by gravel conglomerates, which here, as well as farther up the "Arroyo del Valle", have largely contributed toward the formation of the valley soils, which are of remarkable depth and of easy tillage. The rolling land within the valley southwest of Livermore town has largely a red, stiffish loam soil, containing much small gravel; but at the lower points this red soil is overlaid by a dark-colored loam from 6 to 12 inches in depth.

Nos. 692, 693, and 694 in the following table represent this class of soils, and are from specimens furnished by Colonel George C. Edwards, of the University of California, the results of analysis being here given by his courtesy. The hill lands are scatteringly timbered with oaks.

No representative specimen of the valley soils has been analyzed, the following one being rather of a local aspect, yet giving some insight into the general character of the valley soils.

No. 649. *Sediment soil* from the "Ojo del Monte", a small valley just above the final exit of the "Arroyo del Valle" from the mountains, at the southeastern end of Livermore valley, Alameda county. This soil is a whitish, silty soil, with some tangible sand intermixed, easy of tillage, and of very uniform character to the depth of several feet. It is covered with a dense shrubby and herbaceous growth and some sycamore trees.

Lands of Livermore valley, Alameda county.

	ROLLING UPLANDS.			VALLEY.
	Dark soil.	Subsoil.	Red gravelly soil.	Soil.
	No. 692.	No. 693.	No. 694.	No. 649.
Insoluble matter	80.262	80.658	81.941	71.156
Soluble silica	5.023 } 85.285	5.157 } 85.815	3.756 } 85.697	4.938 } 76.094
Potash	0.299	0.357	0.323	1.143
Soda	0.108	0.121	0.081	0.123
Lime	0.813	0.693	0.720	2.049
Magnesia	0.647	0.666	0.563	3.046
Brown oxide of manganese	0.065	0.025	0.030	0.044
Peroxide of iron	3.584	3.647	3.620	5.648
Alumina	4.933	5.329	5.540	7.153
Phosphoric acid	0.066	0.062	0.061	0.117
Sulphuric acid	0.010	0.008	0.008	0.101
Carbonic acid				1.004
Water and organic matter	4.047	3.435	3.550	3.679
Total	99.857	100.158	100.193	100.201
Humus				0.396
Available inorganic				0.413
Hygroscopic moisture	5.670	6.120	4.530	5.668
absorbed at	15 C.°	15 C.°	15 C.°	15 C.°

These analyses show the difference between the upland and the valley soils to be very great, the latter being rich in potash, highly calcareous, and having a fair, though not large, supply of phosphoric acid; while the upland soils have, for California, an unusually low amount of potash, and a relatively still lower percentage of phosphoric acid. Still, with a fair supply of lime and considerable depth, when well tilled these soils promise well for the culture of the grape, now extensively begun in the region. Evidently, however, bone-meal or superphosphates will be among the first things needed here after some years' culture.

The soil of the level portion of the Livermore valley appears to be a mixture of the red soil of the hills with the valley deposits, and is noted as an excellent country for hay and cereals, though somewhat windy for fruit culture.

REGION NORTH OF THE BAY COUNTRY.

The division of the Coast range north of San Francisco and Suisun bays covers an area of about 20,750 square miles, embracing the following counties and parts of counties: All of Marin, Sonoma, Napa, Lake, Mendocino, Trinity, Humboldt, and Del Norte, and the western parts of Colusa, Tehama, and Siskiyou. The entire region is very generally mountainous, the eastern border being mostly a continuous range, with an altitude of 3,000 feet and more (above 4,000 feet in the western part of Siskiyou county) as far south as the lower edge of Lake county, and thence to the bay falling to the lower hills to less than 2,000 feet, the higher range, however, passing on the west side of Lake and Napa counties to within a few miles of the bay. From the high border region of the east, which in places has a width of 25 miles and more, other ranges of like altitude reach northwestward nearly to the coast, fully

one-third of the entire region lying chiefly in the central and northern parts, thus having an elevation of from 2,000 to 3,000 feet above the sea. The altitude of the rest of the ranges is from 1,000 to 2,000 feet, except a hilly belt of less elevation bordering the ocean, which varies in width from 1 mile in the northern part of Mendocino county to 5 miles or more on the south, and to as much as 25 miles in Humboldt county. Near the coast, opposite or north of the city of San Francisco, is the prominent range of mount Tamalpais, once a part of the Santa Cruz range, but now separated from it by the Golden Gate.

The coast line, while having a general northwesterly trend, is very irregular and broken, with many prominent projections and points, and is indented with numerous bays. Among the former cape Mendocino is the most westerly point in the United States, and is in the line of the southwest trend of the highest mountain ranges of the north in their curve around the great central valley region. Point Arenas and point Reyes form other notable projections. This division of the Coast range is well watered by many rivers, some of the largest of which, with their tributaries, drain belts of country more than 100 miles in length. From the bay northward to the central part of Mendocino county, except in Lake and Napa counties, where the largest streams, Putah, Cache, and Stony creeks, flow into the great valley southeastward, the drainage is either south or west to the ocean. Still northward of this Mendocino water-divide the waters flow northwestward. Russian river is the largest in the southern part of the region; with its headwaters in the central part of Mendocino, it at first flows southward for more than 50 miles, reckoned in a direct course, into Sonoma county, then turns suddenly westward to the coast. Clear lake, a large body of water, not clear, however, in Lake county, has an outlet through Cache creek, eastward through Yolo county, into the Sacramento river. In the region north of the Mendocino divide there are three large and long rivers, the Eel, Trinity, and Klamath. The *Eel*, with its headwaters near those of Russian river, flows northwest and empties into the ocean south of Humboldt bay. *Trinity river*, its two forks heading respectively in the northeast and southwest corners of Trinity county, the former flowing at first southwestward, also has a northwest course to its junction with *Klamath river*. This latter river, the longest of the three, rises on the extreme northeast, flows at first southwestward with a tortuous course into Humboldt county, a direct distance of more than 100 miles, where, after its junction with Trinity river, it turns abruptly and at right angles northwestward into the ocean. Many other streams of the region have also great lengths.

REDWOOD BELT.—The high mountain ranges in the eastern part of the region are almost altogether treeless, except along their lower slopes, which often have a chaparral and oak growth. A prominent feature of the western part is a broad and irregular belt of redwood timber, which reaches uninterruptedly from the northern limit of the state southward a short distance beyond Russian river, in the southern part of Sonoma county, and scatteringly into Marin. In Del Norte county the belt is narrow, widening when it enters Humboldt county to 5 or more miles at first, and to its maximum of a little more than 25 miles in the southern part of that county, in the region of Eel river. Here, however, it becomes suddenly very narrow, 2 or 3 miles in width, and continues so for some distance into Mendocino county, when it again widens to an average width of 10 miles, which width it preserves to Russian river. This belt covers an area of about 2,400 square miles. A southern outlier occurs in Santa Cruz and San Mateo counties, and is mentioned in connection with that region.

The redwood belt is at present the most important timber region of the state, redwood being one of the chief varieties of lumber used in construction. Much of the belt is as yet difficult of access. The soil is in general very productive and moister than that of the adjacent country, but on account of the expense in clearing it is available chiefly where the lumber can be marketed.

AGRICULTURAL FEATURES.—The chief agricultural portion of the northern coast region lies within the counties of Napa and Sonoma and a portion of Lake. Northward of Sonoma county the narrow valleys along the larger rivers form the bulk of the cultivable land. This country is thinly settled, and lumbering and stock-raising, with some mining, are the predominant industries. The valleys are mostly covered with alluvial loams, and are only timbered along the bottoms with a growth of willow, cottonwood, maple, etc. Some of the land of Eel river is very black, and, with its growth of tussock grass, has received the name of "nigger-head soil". Around Ferndale and Mattole there is much eagle fern, which often attains a height of 12 feet. On both the Eel and other rivers northward the tillable land occurs only in small tracts. Around Humboldt bay there is much overflowed or swamp land, bordered on the east by hills containing sandy loam soils, and separated from the coast line by low sand hills having a stunted growth of trees.

The basin of the Klamath is very rugged, particularly that part of it within 40 miles of the ocean. Along the main river there is no valley or bottom land; its whole length is between steep hills and mountains, and through rocky cañons. Its largest tributaries, the Trinity and Salmon, run through a country almost as rugged as that bordering the main stream. Scott and Shasta rivers, which are the only other notable tributaries of the Klamath, have valleys of bottom land about 5 miles wide and 40 long.—*Natural Wealth of California.*

The valley of Russian river, in southern Mendocino and northern Sonoma counties, is narrow, has a sandy loam soil, and for 15 miles from its mouth had originally a timber growth of redwood, but now has only scattered groves of oak. Its lands are alluvial loams, rich and productive under cultivation.

Passing through Sonoma county, and continuous with the southeast course of Russian river, there is a series of valleys reaching to the bay and varying in width from 6 miles in Santa Rosa valley to 3 miles in Petaluma valley, bordered by a range of low mountains on the west and a higher range on the east. Sonoma valley proper leaves

this central valley near Santa Rosa, and reaches southeastward to the bay, with a width of about 2 miles, widening to 6 miles near the bay. That of Napa, separated from it by the Sonoma mountain range, heads near the extinct volcano of Saint Helena, and extends southward 35 miles, with varying width, to the bay.

The soil of these valleys is a rich loam, usually gravelly, and very generally under cultivation, grapes and other fruits being now the prominent crops grown. Smaller valleys lie among the hills, which themselves are, to a large extent, susceptible of cultivation. The country rock is mostly volcanic, largely a soft tufaceous material, tending to form plateau ridges from 1,000 to 2,000 feet above the valleys. These ridges, as well as the slopes of the higher ones, are often quite heavily timbered with a great variety of oaks, among which the black (*Q. Sonomensis* or *Kelloggii*), live (*Q. chrysolepis* and *Wislizeni*), and blue or rock oaks (*Q. Douglassii*) are found on the higher lands, together with Sabin's pine (*P. Sabiniana*) and spruces, and the beautiful madrone tree (*Arbutus Menziesii*), which also descends into the valleys, being there associated with the coast live-oak (*Q. agrifolia*) and white oak (*Q. lobata*), and form desirable agricultural grounds. Here also the Sonoma or black oak assumes its finest development, forming (as near Healdsburg) large spreading trees of the habit of the eastern Spanish oak (*Q. falcata*). Interspersed with the oak growth are tracts of land covered largely with unusually large shrubs, almost trees, of the manzanita (*Arctostaphylos pungens*), which can nowhere be found in greater perfection, its chestnut-brown, shining bark contrasting beautifully with its pale-green leaves and the gray bushes of the chaparral (*Ceanothus*). The densest tree-growth occupies chiefly the northern and eastern slopes, those with a southwest exposure especially becoming too dry and heated in summer. This forest growth, within easy reach of the cultivated lands, has doubtless had its influence in rendering the valleys of Napa, Sonoma, and Petaluma so attractive that at present few uncultivated spots are to be found within them. The vineyards especially are rapidly extending up the mountain slopes, one especial reason therefor being the exemption from spring frosts enjoyed by the several "thermal belts" already referred to.

Along the bay, in the southern part of the region, there is much salt marsh and tule land. Some of this land has been reclaimed and is under cultivation, "two or three years being ordinarily required after leveeing and ditching before it is ready for planting."

But few specimens of soils from the coast region lying northward of San Pablo bay have thus far been received, and hasty personal visits have given me only a very general idea of their character and distribution. Unlike the Mount Diablo range, the mountains of Napa and Sonoma are largely formed by rocks of eruptive or volcanic origin, and where these prevail the soils are naturally different from those of the Cretaceous and Tertiary region south of the bay. The high quality of the wines of the two counties just named has largely been ascribed to the volcanic origin of their soils. Much of the rock constituting the lower and more level portions of the ranges of Sonoma and Napa is a soft, mostly whitish or white tufa, into which cellars have been readily excavated, and which gives rise to a more or less heavy clay soil—white adobe in the valleys, a red and more or less gravelly soil on the ridges. These tufa plateaus alternate with belts and ridges—mostly the higher points—composed of darker tinted, harder, and crystalline or scoriaceous rocks, less easily decomposed than the tufa, and giving rise to soils of a lighter character, gray or whitish in the valleys, from the removal of the iron by leaching. Of course there are all kinds of transitions between these two extremes, and occasionally even a genuine black adobe will locally show the prevalence of the calcareous sedimentary rocks.

The two samples from Sonoma, of which the analyses are given below, represent, respectively, the lighter sediment soils of the Sonoma valley lying near the foot of the slope and the red soil of the mountain sides themselves.

No. 185. *Valley soil* from the lower portion of the vineyard of G. F. Hooper, lying within a hundred yards of Sonoma creek, Sonoma county, taken to the depth of 12 inches. This soil is a medium light loam soil of a reddish-buff tint when dry, but blackish when wet. The dry lumps crush readily between the fingers and soften quickly when wet, but show some plasticity, so that the soil cannot be worked when very wet. It has grown excellent Zinfandel grapes for a number of years, and was originally timbered with oaks and grape-vines.

No. 188. *Red mountain soil* from the higher portion of G. F. Hooper's land, now occupied by orange and chestnut trees, taken to 12 inches depth, and similar in appearance for 2 or 3 feet. This soil is a brownish-red loamy soil, containing rock fragments intermingled; but the color darkens somewhat in wetting, and the dry lumps can be crushed by the fingers, but soften slowly on wetting, and become only moderately plastic. The soil is quite light in tillage, and produces well, and is evidently especially adapted to fruit culture, favoring early fruiting as well as early maturity. The original growth is oaks, manzanita, and some "chaparral".

No. 672. *Napa valley soil* from the vineyard of J. H. Wheeler, 2 miles south of Saint Helena, Napa county; a grayish sediment soil, with some coarser sand in the subsoil; taken to 12 inches depth. It is easily tilled, in low places tending to be heavy, and is much benefited by underdrainage. Then natural vegetation originally was oaks, grasses, etc. The soil has been under cultivation for some time.

Vineyard soils.

	Sonoma county.		Napa county.
	Sonoma valley soil.	Red mountain soil.	Napa valley soil.
	Hooper's vineyard.	Hooper's land.	South of Saint Helena.
	No. 185.	No. 188.	No. 672.
Insoluble matter	76.089	34.392	77.017
Soluble silica	6.839	14.110	3.340
	82.928	48.502	80.357
Potash	0.435	0.319	0.746
Soda	0.123	0.058	0.477
Lime	0.744	0.670	0.600
Magnesia	0.578	0.712	1.331
Brown oxide of manganese	0.025	0.146	0.041
Peroxide of iron	5.793	25.955	5.656
Alumina	5.092	12.160	5.671
Phosphoric acid	0.187	0.166	0.101
Sulphuric acid	0.171	0.274	0.050
Water and organic matter	3.715	11.640	5.252
Total	99.791	100.602	100.282
Humus	1.111	2.537	1.685
Available inorganic	0.371	1.171	0.457
Hygroscopic moisture	4.980	13.710	4.503
absorbed at	15 C.°	15 C.°	15 C.°

While differing widely in their aspect and physical properties and in some points of their chemical composition, Nos. 185 and 188 are yet not very far apart in the most essential point—the supply of plant-food. In its percentages of potash, phosphoric acid, and lime the mountain soil stands somewhat below the valley soil; yet the supply of all three is fair. In humus the mountain soil exceeds that of the valley nearly one and a half times, and this, together with its extraordinary iron percentage, accounts for its very high power for absorbing moisture, and forms a very effective safeguard against injury from drought. On the whole, the advantages of the two soils are very evenly balanced, its location giving the valley soil a similar degree of security against drought; but it is evidently more liable to injury from frosts and wet than the hill soil. The latter, with its eastern exposure, seems certainly pre-eminently adapted to grape culture; and this adaptation is confirmed by the excellent results obtained in the vineyards of Köhler & Froehling, located on a similar soil higher up the valley, as well as in the well-known Schrammsberg vineyard, northwest of Saint Helena, in the Napa valley. I think it probable that, whenever quality shall be more evenly balanced against the mere quantity of production, the red mountain slopes of both valleys will be occupied by vineyards as high up as the vine will grow and produce the choicest wines of the region. In the Napa valley especially the vineyards are steadily advancing up the hillsides already, and on Howell plateau, at an elevation of 2,000 feet, they seem to promise excellent results. Here also we have a red, though somewhat heavier soil, timbered with a great variety of oaks and some nut pine, and it was on such soil that an excellent staple of cotton was grown in 1881 by Dr. H. Kimball, of Napa.

The Napa valley soil differs from the Sonoma soils in two chief points. It is considerably richer in potash, and, on the other hand, considerably lower in phosphates, as well as somewhat lower in lime. It may be that in both these respects the cultivation it has undergone exerts a depressing influence upon the results. At the same time, the abundant potash, no doubt, has some connection with the extraordinary crops sometimes grown in the Napa valley, amounting frequently to over 10 tons, and in a late and well-authenticated case to over 16 tons of grapes per acre. While such extraordinary production cannot be expected to yield first-class wines, yet its profitableness is beyond question.

No. 676. *Red volcanic soil* from a flat on Clear lake, Lake county, sent by Mr. S. B. Shaw, and stated to be representative of a large proportion of the cultivable land of the region; taken from a newly-planted vineyard to 12 inches depth. Below that depth the color is even higher and the soil more clayey; but between 2 and 3 feet it becomes of a lighter tint, and is less clayey.

The volcanic soil is of rather unusual composition and highly ferruginous, with an extraordinary amount of soluble alumina, which is not adequately represented in the shape of clay, as shown in the mechanical analysis given farther on, as well as in the small percentage of soluble silica. The supply of potash and lime is fair, yet not large for so clayey a soil. Phosphoric acid is very low, so that it is sure to be greatly needed after a few years' cultivation. Half of it, however, is shown to be in an available form by the humus determination. The supply of humus is ample, and moisture absorption high. Altogether, the soil is not one adapted to cereal culture, but will doubtless yield in that climate choice crops of fruit.

The only other soil sample from the northwestern part of the state thus far examined was sent by Mr. Waddington, of Ferndale, Humboldt county.

No. 207. *Soil of Eel river bottom* from three miles east of Ferndale, Humboldt county, taken to a depth of 12 inches. This is a gray silty soil, blackish when wet, and when worked in that condition somewhat adhesive and plastic, and very uniform for a long distance within the limits of the bottom. Original growth not reported. This soil produces excellent grain crops for four or five years, and continues to do so in favorable seasons; but after some years' cultivation it seems to "run together", so as to be difficult to till, and after late overflows especially becomes intractable for the season, so as to materially abridge crops. The analysis was requested with a view to determine how to obviate this trouble.

No. 205. *Subsoil* of the above, taken from 12 inches depth down to 25 inches. This subsoil is very similar in appearance to the soil, but slightly heavier, and is of lighter gray tint, with an occasional grain of bog ore.

Lands north of the bay country.

	LAKE COUNTY.	HUMBOLDT COUNTY.	
	Red volcanic.	Eel river bottom land.	
	Soil.	Soil.	Subsoil.
	No. 676.	No. 207.	No. 205.
Insoluble matter	49.604	65.346	69.373
Soluble silica	5.934 } 55.538	6.896 } 72.242	3.588 } 72.961
Potash	0.452	1.127	1.134
Soda	0.170	0.282	0.120
Lime	0.658	0.105	0.101
Magnesia	0.610	3.329	3.239
Brown oxide of manganese	0.051	0.117	0.054
Peroxide of iron	10.477	6.986	7.307
Alumina	22.585	10.236	9.758
Phosphoric acid	0.031	0.167	0.141
Sulphuric acid	0.033	0.020	0.026
Water and organic matter	9.654	5.629	4.665
Total	100.259	100.240	99.506
Humus	1.442	1.250	0.652
Available inorganic	0.398	0.500	0.427
Available phosphoric acid	0.014		
Hygroscopic moisture	11.110	7.870	6.212
absorbed at	15 C.°	15 C.°	15 C.°

The analyses show the bottom soil to be one of great native resources—an unusually high percentage of potash and a very fair supply of phosphoric acid—there being a remarkable uniformity of composition through the entire soil-mass examined. The subsoil contains somewhat less phosphoric acid, and, of course, less humus; but in the surface soil the supply of both is ample. The one deficiency apparent in both is that of lime, the percentage of that important soil ingredient being smaller than in any other soil of the state thus far examined and unusually out of proportion to the other ingredients. This lack of lime accounts at once for a certain lack of thriftiness even in the virgin soil, and equally for the difficulty in tillage complained of. A few years' cultivation will still further reduce the small amount of lime in the surface soil and render it inadequate, not only for the maintenance of thriftiness, but also for that necessary condition of tilth, the "flocculation" of the clay. In the absence of a sufficiency of lime the clay assumes the "tamped" condition in which it is desired to be for the purposes of the potter, but not for those of the agriculturist; for it will then cause a clogging of the plow and the formation of hard lumps whenever the soil dries.

It is evident that liming is the first thing needful for those cultivating the Eel River valley soils, but whether lime or marl can be procured by them at a cost making its use practically possible I am not able to say. It is possible that limestone suitable for agricultural use exists in the region. In the meantime green manuring would help, in a measure, to obviate the difficulty, until better communication shall enable the farmers to use freely the obvious and best remedy on their otherwise so generous soil.

SIERRA NEVADA MOUNTAIN REGION.

The middle and northern portions of the eastern side of the state embrace the very high mountain chains known as the Sierra Nevada, which rise to elevations of 8,000 and 10,000 feet and more above the level of the sea, the elevation of some of the highest peaks being nearly 15,000 feet, forming a backbone-like though irregular chain in its

center from north to south and dividing the region into what has been termed the eastern and western slopes. The former falls off rather steeply into a plateau region, which is elevated some 5,000 feet or more above the sea, and is the western limit of the Great American basin or desert. The western slope, known as the foot-hills of the Sierra, and to whose maximum elevation of 4,000 feet the Sierra proper usually falls off abruptly, reaches westward with a much gentler slope to the low valley lands of the Sacramento and San Joaquin rivers. This foot-hill region is, however, subdivided into an *upper or broken region*, which has an elevation of 2,000 feet and upward to the foot of the Sierra mountains, and properly belongs to that division, and a *lower region*, whose elevation is less than 2,000 feet, and which, being an important agricultural country, is separately described as the *foot-hill region.*

The Sierra Nevada ranges may be traced in consecutive order for an immense distance, the whole country for nearly 500 miles in length and nearly 100 miles in width—their extent within the limits of the state—being subordinate in configuration to two lines of culminating crests, which impart a peculiar character to its topography, while in the Coast range all is confusion and disorder.

The highest peaks of the Sierra Nevada, from mount Shasta on the north, including Lassen's butte, Spanish peak, Pilot peak, the Downieville buttes, Pyramid peak, Castle peak, mounts Dana, Lyell, Brewer, Tyndall, Whitney, and several others not yet named, which reach from 10,000 to 15,000 feet above the level of the sea, are nearly all in a line running north 31° west. On the eastern side of this culminating line of peaks is situated a series of lakes, the principal of which are Klamath, Pyramid, Mono, and Owen's, lying wholly to the east of the Sierra, and Tahoe, occupying an elevated valley at a point where the range separates into two summits. The confluence of the Gila and Colorado rivers forms the southern limit of the depression in which these lakes are located. A somewhat similar depression exists on the western slope of this ridge of high peaks, which is also about 50 miles wide, and is terminated by another series of peaks remarkably continuous in their direction and also containing a series of lakes. That section which lies to the east of the culminating peaks is generally termed the eastern slope. The depression on the west of this range and the subordinate range of peaks which bound this depression on the west is considered as the Sierra proper.—*Natural Wealth of California.*

The following are the elevations of some of the most prominent peaks, as determined by the United States surveys:

	Feet.
Mount Lyell	13,217
Mount Dana	13,227
Mount Brewer	13,886
Kaweah Peak	14,000
Mount Tyndall	14,386
Mount Shasta	14,442
Mount Whitney	14,898

The Sierra region, with its eastern and western slopes (omitting the lower foot-hills), embraces an area of a little more than 37,000 square miles. Uniting, as it does, with the Coast range of mountains on the north and south of the great valley, the line of separation between the two mountain regions becomes rather arbitrary. This is especially the case on the north, where mount Shasta and the valleys of the Sacramento and Shasta rivers, reaching from the great valley northward to the Oregon line, form a convenient line of separation, though the high mountain range, with a height characteristic only of the Sierra, extends much further southwestward toward cape Mendocino. Similarly on the south this high altitude belongs in part to the San Bernardino mountains, which trend with the Coast range and are included in the southern agricultural region.

The western limit of the region passes from the north, southward through the central part of Siskiyou county, into Shasta, thence extends in a very irregular southeast course to the southern part of Fresno, and turns southward to the southern part of Kern. The region includes the following counties and parts of counties, beginning on the north: The eastern parts of Siskiyou and Shasta; all of Modoc, Lassen, and Plumas; a small portion in the eastern parts of Tehama and Butte; nearly all of Sierra; the eastern parts of Nevada, Placer, El Dorado, Amador, Calaveras, Tuolumne, and Mariposa; all of Alpine and Mono; the western part of Inyo; the eastern halves of Fresno and Tulare, and the central portion of Kern, at whose lower line the region terminates almost in a point against the Coast range.

The prominent features of the Sierra region as thus outlined are: First, its somewhat central though irregular belts of high mountain ridges, their snow-capped summits towering thousands of feet above the rest of the region; second, a western slope of high and broken hills, mostly well timbered; third, an eastern slope, falling rapidly to an elevation of 5,000 feet, and interspersed with minor mountains, valleys, and great lakes, and on the north with large lava bed plateaus.

The high central range of mountains is a natural water-shed, throwing the drainage of the two slopes, respectively, east into the great basin in the state of Nevada and west into the Sacramento and San Joaquin rivers. An exception to this is Pitt river, which, rising in the northeastern part of the state, flows southwestward, cutting through a low portion of the Sierra chain and forming the chief tributary of the Sacramento river. The western slope is well watered by innumerable streams, large and small, the headwaters of nearly all of the large rivers of the great valley. The eastern slope contains very few streams of any size within this state. The mountains are usually timbered with pine, fir, cedar, etc. The entire Sierra region, as a whole, is sparsely inhabited, and its population is confined almost exclusively to mining towns, wood-cutter's camps, and a few railroad stations, and, if evenly distributed, would average but little more than one person per square mile. In some of the valleys on either side of the central range some farming and stock-raising is carried on, but mining is the chief pursuit of the people. In summer time large herds of stock, especially sheep, are driven to the mountain pastures from the plains.

THE BROKEN REGION OF THE WESTERN SLOPE.

The high and broken belt of country lying immediately at the foot of the high Sierra, and known as the higher or broken foot-hill region, has an altitude of from 2,000 to 4,000 feet above the sea; its width varies greatly, but is usually about 10 or 15 miles. In Plumas county this region spreads out to 35 or 40 miles, while in other places it narrows to not more than 5 miles. The rise from the lower foot-hills is often so gradual that the line of separation cannot be definitely marked out, while from the eastern border of this region the high Sierra mountains usually rise very suddenly to their great altitude. It is estimated that the region covers about 8,000 square miles. Of its topographical and agricultural features but little is generally known beyond the fact that it is throughout extremely broken with rugged hills and but few valleys, the streams mostly wending their way across the belt in deep chasms and cañons. The region is generally well timbered with oaks, pines, firs, and other growth, with big trees (*Sequoia gigantea*) in Calaveras and adjoining counties.

Lumbering and mining constitute the chief industries of the extremely sparse population, and the few settlements and towns found here and there are usually little else than camps, with a few necessary stores and trading posts. Little farming is done, as there is but a small portion of the entire region that is suitable for cultivation. In Plumas county, where the belt takes its greatest width of about 40 miles, there are a number of grassy and well-watered but treeless valleys, which stretch across the country for 100 miles in a southeastern direction, connected with each other by cañons, passes, or low divides, and have areas varying from 3 to 8 miles long and from 1 to 4 miles wide. These are Big Meadows, Butte, Indian, Genessee, Clover, and Sierra valleys, and are more fully described under the head of Plumas county, page 123.

The lands of these valleys are usually sandy, derived mostly from the metamorphic rocks that form high mountains on either side. The basin called American valley, in which the town of Quincy is situated, is about 11 miles long and from 2 to 3 miles wide, and has an elevation of 3,500 feet above the sea. This part of the region is principally occupied by the metamorphic rocks over an area of about 30 miles in diameter; but this is almost entirely surrounded by volcanic materials, the great lava streams which have come down from Lassen's peak on the north and Pilot peak on the south uniting with the volcanic crest of the Sierra, so as to cover the slates around three-quarters of the circumference of the circle. Between Indian and Big Meadows valley the edge of the great volcanic region is struck; from here the mass of lava extends almost uninterruptedly to the Oregon line and far beyond.—*Geological Survey of California.*

THE EASTERN SLOPE.

Nearly all of the region lying east of the Sierra chain is desolate in the extreme, and its surface is broken with mountains, ridges, and hills, and scarcely inhabited. Its southern part embraces large desert areas, its northern immense beds and table-lands of lava, while in its central part the state line approaches so near the Sierra chain as to leave very little of the slope within California. This region, even were its altitude lower than it is, affords very few facilities for profitable farming. Valley lands are found here and there, but these partake so much of the desert character of the southern part of the state, or are covered to such an extent by the volcanic materials throughout the region, as to be in many instances useless. We find, however, some large valleys that contain much good land that is at present partly under cultivation, and these are described separately. Excellent timber, comprising pine, fir, and cedar, covers many of the mountains, making lumbering one of the industries of the people. Cattle-raising is also largely engaged in, while in some of the counties, especially in the middle and southern portions of the region, mining is the chief occupation. The following descriptions are given of the chief valleys of the region, beginning on the south:

Owen's valley is a narrow basin between extremely lofty mountains. It is about 140 miles in length, north and south, and its average width is about 10 miles. Along its western edge it is bordered by the Sierra Nevada, which presents an almost unbroken wall in this part of its course, rising in its highest peaks, which are opposite Owen's lake, to 15,000 feet, and having no pass across it of less than 11,000 feet in elevation. Here the descent from the summit of the Sierra to the valley must average fully 1,000 feet per mile, and this would seem to be one of the steepest mountain profiles in the country. This portion of the Sierra as seen from the valley is peculiarly grand. The steep slopes rise from the desert plain and are everywhere naked and destitute of forests, the only trees being the pines in the cañons and the scattered nut-pines, which are scrubby and small, and extend up to about 8,000 or 9,000 feet, the rest of the ridges being made up of patches of bare soil, with exceedingly steep slopes of naked gray rock or snow. On the eastern side of the valley the mountains are more broken, but almost as high and grand as those on the western, and apparently forming a continuous range, called Inyo mountains on the south and White mountains farther north. The mountains are very dry and desert-like, not a single stream of any size flowing from them into Owen's valley, which is exclusively supplied with water by the melting of the snow stored away during the winter on the upper part of the eastern slope of the Sierra. The White and Inyo mountains are destitute of forest vegetation except a few scattering, scrubby pines, mostly the nut-pine (*Pinus Fremontiana*).

The tributaries which Owen's river receives from the Sierra are small streams. As they issue from the mountain cañons they flow out upon great piles of detritus or washes, consisting of coarse and fine *debris*, brought by the stream from the mountains and piled up on the plain with a gradual slope to the valley. This slope of detritus extends along the whole base of the mountains, but is highest where the streams come out, so that the latter often separate into several branches as they flow down it, thus making irrigation quite easy, and giving rise to a considerable expanse of meadow and cultivable land along the various channels. Lava beds extend from the mountains on the east and west, the two sometimes nearly meeting in the middle of the valley. In the region of Fish springs the lava bed on the west side of the valley is about 15 miles wide, and on the east about 10 miles. On the north lava occupies nearly the whole of the valley, and is highest along its center. Very little of the land of this valley is under cultivation, the tillable areas lying in small tracts, mostly in the southern half, in the region of Independence.—*Geological Survey of California.*

In Mono county there are two important valleys that are partly under cultivation, *Big Meadows* and *Antelope*, each about 10 miles long and very narrow. Their soils are mostly alluvial or of a dark soddy character, covered with grass, with some willow trees along the streams. The valley of *Honey lake*, in Lassen county, is about 60 miles long from east to west and from 15 to 20 miles wide. Its northern portion is dry and barren, and, with the exception of sage-brush and greasewood, is destitute of vegetation. On the west and southwest, near the Sierra, there is a strip of good farming land about 2 miles wide under cultivation. The soil of this part is a sandy loam, yielding with irrigation, which is necessary, from 25 to 30 bushels of wheat per acre. A number of other small valleys lying along the borders of small lakes in this region are chiefly devoted to grazing purposes. On the northwest of Lassen county *Big valley*, on Pitt river, covers a large region, embracing some good land, and is bordered on the east by long, oval hills and extensive table-lands, known as the Madaline plains. The surface of the valley is mostly covered with sage-brush; its soils vary from red clays to dark loam and gravelly lands, and are spotted with alkali tracts. The valley is chiefly devoted to stock-grazing.

The only other valleys worthy of mention are those that border the lakes in the northeastern part of the state, viz, Goose Lake valley and Surprise valley. The valley of *Goose lake* lies mostly on the eastern side of the lake, reaching back some 4 or 5 miles, and is watered by several small streams. Its lands are said to be good for farming purposes. They are covered with bunch and other grasses, and are partly under cultivation, yielding crops of wheat, barley, oats, etc. The adjoining mountains are heavily timbered with cedar and pine, while on the hillsides and around the lake is an abundant growth of wild plums. On the west side of the lake there is a narrow strip of valley devoted to dairying. *Surprise valley*, east of this, lies north and south along the state line for 60 miles, and has a width of about 15 miles. Three lakes lie within its basin, while on either side it is bounded by high and timbered mountains. Its surface is covered with grasses, and its soil is a rich black loam, occupying a strip from 2 to 6 miles in width, whose surface gently slopes to the lakes. The valley is settled in neighborhoods, and is partly under cultivation. Stock-raising and lumbering are carried on to a considerable extent.

THE LAVA-BED REGION.

A large proportion of the northeastern part of the state, from Feather river, in Butte and Plumas counties, northward to the state line, and from the Sacramento and Shasta valleys eastward to the eastern part of Modoc county, is covered to a depth of several hundred feet with great beds of lava and other volcanic material, and has generally a broken surface. The exact extent and outline of the region is not known, but it covers the eastern portions of Siskiyou, Shasta, and Tehama counties, the western part of Lassen county, the northwestern part of Plumas, and the greater part of Modoc. As determined by the state geological survey, the limit reaches on the southwest to within a few miles of Oroville, Butte county; thence northward its western limit reaches quite to the Sacramento river, near Antelope creek, in Tehama county, but recedes from it to the east beyond Battle creek, passing a little to the east of Fort Redding. The western edge of the great volcanic plateau may be traced in a line nearly northeast from that point for a distance of about 25 miles; it then bends to the northwest, and follows nearly that course to the north line of the state, passing a little to the east of Yreka, Siskiyou county.

The surface of this large region is much broken, and is interspersed with hills and high volcanic cones, frequently cut into deep chasms by the few streams that occur in the region. On the north extensive caves have been found under the lava-bed. Pluto's cave, 4 miles north of Hurd's ranch, in Shasta valley, Siskiyou county, is described as being under a lava table which slopes to the north, its surface very rough, raised into domes or blisters, and having a thin, dry soil. The cavern is a long gallery extending under this table, now open for about a mile in a northwest direction. Near the entrance the roof has fallen in several places; but otherwise the gallery is continuous, and has a width varying from 20 to 50 feet, the height being in some places as much as 60 feet. Throughout most of its extent the cavity is beautifully arched, having a section resembling that of an egg set up on its smaller end. The rock at the top and sides often has a concentric structure parallel with the sides of the arch. In places there are considerable quantities of spongy lava, which seems to have oozed from the sides in a frothy state. The whole appearance of the place is that of a cavity produced by the flowing out of the liquid lava after the sides and top had become consolidated. Excepting only the valleys mentioned above, the entire region covered by these beds is barren and desolate and almost without habitation, or lands that could be profitably tilled.

The lava-bed section at the northwest corner of Modoc county is a succession of gulches and crevasses which range from a few feet to 100 feet in width, and many of them are 100 feet deep; some have subterranean passages which lead for miles under the rocks. This broken country extends in a belt eastward to Goose lake.

This lava section of the country has no arable lands, and it is fit only for grazing purposes. It is a vast plain or table-land, and in some places it is sparsely covered with juniper.

Pitt river flows for 15 miles from Goose lake through a desolate plateau covered with large bowlders and masses of blackened lava, known as the Devil's garden, at the end of which it rushes, roaring and foaming, through a deep defile, named, from its wild and rugged aspect, "The Devil's cañon." Emerging from this gorge, it meanders quietly through Spring valley, so called because of a deep pool of hot water situated on its banks, which, agitated by the chemical action going on in its subterranean chambers, throws a volume of water as large as a hogshead to a height of 10 feet, which falls back into a large circular basin with the noise of a mountain cascade. The country adjacent to Pitt river, and with few exceptions the immediate valley of the stream itself, is for the most part an arid, barren, and timberless region. There is, however, some good land along the river in the southern part of the country, where also the juniper and cedar attain a size making them serviceable for fuel.—*Natural Wealth of California.*

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Between Cow creek and Bear creek, Shasta county, there is a broad plain of volcanic ashes, destitute of trees, and almost bare of herbage, and as yet hardly at all eroded into cañons. On nearing Bear creek more solid lava makes its appearance and increases as we pass south. These volcanic materials are all derived from the great center of eruptive agencies at and near Lassen's butte. The examination of the region between that now extinct volcano and the Sacramento river shows that there were a large number of smaller volcanoes once active there, and that these added extensively to the mass of ejected materials. These consist of layers of ashes and scoriæ, alternating with hard basaltic lava, and they now cover a district about 100 miles long, from Pitt river south to Oroville, and nearly 75 miles wide. Between the mouth of Bear creek and Red bluff the volcanic rocks come entirely down to the river. They may be well studied at Battle creek, which rises at Lassen's butte, and has cut a deep cañon in the stratified lava, which is in places as much as 500 feet deep. The basaltic lava seems to have flowed in sheets over the surface, forming a regular slope from Lassen's butte to the Sacramento. All along Deer and Chico creeks, in Tehama and Butte counties, the lava terminates with an abrupt edge, and the plain beneath and nearest to it is barren and dry and covered with volcanic fragments; but farther down toward the river the land becomes gradually fertile, and has considerable timber. The proportion of good agricultural land increases as we approach Chico creek, where the plain is about 10 miles wide.—*Report Geological Survey of California.*

Southward from this great lava region the signs of a former volcanic activity in the high Sierra mountains are abundant, and we find as a prominent feature in many of the counties beds of basaltic lava capping some of the mountains, while on the western slope, and down into the lower foot-hills, there are still the remains of what were once heavy flows of lava from these mountains. In El Dorado county such can be traced through the central part of the county from east to west. In Amador the volcanic remains lie chiefly along the southern part of the county, "the great volcanic table or lava flow extending up the ridge between the Cosumnes and Mokelumne rivers." In Calaveras a belt reaches eastward from the northwestern part of the county to the north side of Cave city and the "big trees" and beyond.

The table mountain of Tuolumne county is a flow of lava originating in the lofty volcanic region beyond the "big trees" of Calaveras. It comes down on the north side of Stanislaus river, forming a nearly continuous ridge, elevated more than 2,000 feet above the river. Just below Abbey's ferry the river has broken through the once continuous basaltic ridge, which has been irregularly worn away for some distance from the river, but which reappears as a continuous mountain chain a little southwest of Columbia, and continues on the south side of the river, forming a conspicuous feature of the scenery as far as Knight's ferry, a distance of about 20 miles from the point where it crosses the river and enters the county. The surface of the mountain is very level, with hardly a trace of soil or vegetation.—*Geological Survey of California.*

South of Tuolumne county scarcely any volcanic accumulations have been found to show lava flows, though volcanic action is apparent in some of the mountains of the Sierra.

ALKALI SOILS AND IRRIGATION WATERS OF CALIFORNIA.

Alkali soils (*a*).—This name is applied in California almost indiscriminately to all soils containing an unusual amount of soluble mineral salts, whose presence is frequently made apparent by the "efflorescence", or blooming-out on the surface, of a white powder or crust, soluble in water. This "alkali" becomes most apparent in dry weather following upon rains or irrigation. Later in the season it usually becomes less perceptible from intermixture with dust, as well as from the failure of the soil-water to rise near enough to the surface. The first rain, dissolving the salty substances, carries them partly into the water-courses, but chiefly back into the soil, whence they rise again at the recurrence of dry weather.

The immediate source of the "alkali" is usually to be found in the soil-water, which, rising from below and evaporating at the surface, deposits there whatever of dissolved matters it may contain. Such water, when reached by digging, is by no means always perceptibly salty or alkaline, and the same is mostly true of the soil an inch or two beneath the surface; for since the soil, acting like a wick, draws up the soil-water and allows it to evaporate at the surface, it is *there*, of course, that all the dissolved matters accumulate, until the solution becomes so strong as to injure or kill all useful vegetation. The injury will usually be found to be most severe just at or near the crown of the root, where the stem emerges from the soil.

One obvious and practically important conclusion to be drawn from the above considerations is that the more water evaporates from the surface of the soil within a season the more alkali salts will be drawn to the surface. Hence, within certain limits, a greater rainfall will bring up a larger amount of alkali; or if, instead of rain, surface irrigation is made to supply an additional amount of water, the same effect will be produced; always provided that the rainfall or irrigation does not go so far as to actually wash a portion of the salts definitely beyond the reach of surface evaporation into lower strata, from which springs or seepage will carry them into the country drainage.

The measure of the rainfall or amount of irrigation water that will accomplish one or the other of these opposite results depends in a large measure upon the nature of the soil as well as of the underlying strata. It is more difficult to wash the soluble salts out of a clay soil than out of a sandy one, and the moisture and accompanying salts will keep rising through the former from greater depths and for a greater length of time after the cessation of rain or irrigation.

Roughly speaking, there is in California an obvious *inverse* relation between the rainfall and the prevalence of "alkali" in the soils. The concurrent increase of alkali and decrease of rainfall to southward is most obvious in the great valley, but is also observable more or less to seaward of the Coast range. The alkali question is of general importance chiefly in that part of the state lying southward of the city of Sacramento. In the region north of that latitude the more copious rainfall seems to keep soils leached of their alkali, if, indeed, it is naturally as abundant as in the San Joaquin valley.

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a So far as I am aware, no systematic investigation and discussion of this subject in its relations to agriculture has been made outside of the state of California, where the preponderance of the agricultural interest and the frequent interference of "alkali" with the extensive culture has forced public attention to the question, the more because of its intimate connection with the all-important subject of irrigation. I have therefore considered it best to present here somewhat in detail the experience and results obtained in the work done in California under my direction, published in the reports of the agricultural college of the University of California for the years 1877, 1879, and 1880, or subsequently elicited.—E. W. H.

Another conclusion resulting from the principles above mentioned is that in the practice of irrigation the nature of the water used is of great importance, since what it contains of soluble salts will be left in the soil by evaporation, helping to swell the mass of alkali year after year until it may become so great as to render the land unfit for cultivation; provided, again, that the amount of irrigation water used is not so great as to sink through into the strata supplying the country drainage, carrying with it its soluble ingredients also.

Effects of alkali.—While the corrosive action exerted by the alkali salts upon the root crowns and upper roots of plants is the most common source of injury, there is another source of injury which manifests itself mainly in the heavier class of soils thus afflicted, when the soluble salts consist largely of the carbonates of soda and potash. This is the great difficulty or almost impossibility of producing a condition of true tilth, in consequence of the now well-known tendency of alkaline solutions to maintain all true clay in the most impalpably divided or tamped condition, that of well-worked potter's clay, instead of the flocculent condition which it assumes in a well-tilled soil.

As this cause of injury is not so well known as the one first mentioned, it will be pertinent to adduce an example observed and studied in the neighborhood of Stockton, San Joaquin county, California, from where a belt of land of this character, about 1 mile wide and 14 miles in length, traverses the valley diagonally to the foot-hills of the Sierra.

This area is readily recognized by its pitted or "pock-marked" appearance, the low portions being impregnated with alkali and more or less incrusted with it on the surface during the dry season, while after rains pools of dark-tinted water remain standing on them for weeks after the higher portions are dry and in tillable condition. These higher portions, forming hillocks and ridges, elevated on an average from 10 to 18 inches above the alkali spots, and also bordering the whole tract, consist of a fine, mellow, loam soil, such as would be chosen for a garden, and very productive wherever the alkali does not influence it. Unfortunately, it lies so intimately interspersed with the alkali spots that it is practically impossible to cultivate one without the other. A short time before my visit the owner, Mr. C. L. Overhiser, had made a desperate attempt to conquer the refractory alkali soil. A mixed tract of the two soils had been plowed, cross-plowed, rolled, and harrowed until the harrow produced no further effect, and the result was a seed-bed of soil-clods ranging from the size of a pea to that of a billiard ball, but having no tilth. At the same time the portions of the "ridge" soil so treated were reduced to an ashy condition of tilth. Some of the alkali land had also been heavily manured, and a fair stand of grain was springing up, but Mr. Overhiser stated that, in accordance with previous experience, he expected to see the stalks "spindle up" and turn yellow about the time of going to ear, unless the weather continued unusually moist, so as to prevent the rise of the alkali to the root-crowns.

Inspection seemed to show that the two soils differ but little in mechanical composition, not nearly enough to account for such difference of tilling qualities; for when worked into a paste with water it was difficult to say which of the two was the heavier soil, and on drying from this condition both formed lumps about equally hard. For the final determination of this question the two kinds of soil were subjected to comparative mechanical analyses. Both subsoils are very much alike in appearance, being of a gray tint, very compact, and disposed to be cloddy. Both show an alkaline reaction on litmus paper (bluing the red paper), the subsoil of the alkaline spots being, however, decidedly the stronger. The mechanical analysis of the two surface soils resulted in showing that the difference in their proportions of clay and sandy ingredients of the several grades is so slight that under ordinary circumstances it would be insensible in tillage. The chemical examination of the soils resulted thus: The non-alkaline surface soil shows with blue litmus paper a faintly acid reaction (as is usually the case in cultivated soils). The alkaline surface soil shows a sharply alkaline reaction on litmus paper, and portions of it exhibit on the surface white needle-shaped crystals, apparently of carbonate of sodium. In the dead-furrows on the alkali tract stood puddles of dark-colored water, an analysis of whose solid contents is given below, alongside of that obtained by leaching the alkali soil in the laboratory, evaporating the coffee-colored lye, and burning off the vegetable matter. The total amount of residue obtained by the latter process amounted to a quarter of one per cent. of the dry soil. Of this amount 0.158 was again soluble, 0.093 remaining behind as earthy salts, etc. The soluble and insoluble parts were constituted thus:

SOLUBLE PARTS.			INSOLUBLE PARTS.	
Constituents.	Soil extract.	Dead-furrow puddles.	Constituents.	Dead-furrow puddles.
	Per cent.	*Per cent.*		*Per cent.*
Carbonate of soda	52.74	64.01	Carbonate of calcium	14.02
Chloride of sodium	33.08	13.06	Tri-calcic phosphate	5.37
Sulphate of soda	13.26	22.93	Tri magnesic phosphate	5.77
Tri-sodic phosphate	1.83		Silica (soluble in Na_2Co_3)	24.37
			Iron oxide, alumina, and some clay (by difference)	50.47
	100.91	100.00		100.00

It will be observed that, notwithstanding the presence of considerable amounts of neutral sodium and calcium salts (which tend to render the soil more tillable), about 0.08 per cent. of carbonate of sodium was sufficient to render the soil practically untillable. Although this effect is much less perceptible in the case of soils containing less clay, it cannot fail to be, in many cases where it is not obvious, a determining cause in turning the balance of profit and loss the wrong way, especially in critical seasons. The change of carbonate of soda to some other form, at least, is therefore among the most important points to be gained in the reclamation of alkali lands; and fortunately this can be accomplished with little cost or difficulty by the application of gypsum or land plaster.

Another damaging effect of the alkaline carbonates upon the soil is the dissolution of their humus, which manifests itself in the dark color of the water standing on alkali spots and in the black rings left where such water evaporates, whence the popular name of "black alkali." When leached with water such soils will often appear almost white, and will remain unthrifty for some time until the humus is restored by vegetable decay. The application of gypsum prior to leaching, however, renders the humus insoluble again, and thus prevents its waste.

Reclamation of alkali lands.—The most obvious remedy for this evil is, of course, the leaching-out of the injurious salts by flooding, and, if possible, by underdraining. This method is habitually resorted to in sea-coast marshes, near the mouths of rivers, after the salt water has been excluded by embankments. The limited salty spots so frequently met with in the uplands of some regions are promptly cured by a few underdrains, through which the winter rains wash the salts definitely beyond the reach of the soil-water. Such spots are very commonly found extraordinarily fertile afterward. The problem of affording relief, however, becomes much more difficult when either a

stratum of saline water or an earth-layer containing much saline matter lies a few feet beneath the surface in a level region, as is unfortunately very often the case in California. When this happens the evil can only be mitigated, but scarcely altogether cured. According to the value of the land to be reclaimed, one or several of the following remedies may then be employed:

1. When the "alkali" is not very abundant, or very noxious, *frequent and deep tillage* may afford all the relief needed. For inasmuch as the damage is in most cases the result of an excessive accumulation *at or near the surface*, it is clear that frequent intermixture of the surface layers with the deeper portions of the soil may so dilute the injurious salts as to render them powerless for harm.

Moreover, since a perfect tilth of the surface greatly diminishes evaporation, it tends to diminish, concurrently, the accumulation of the alkali near the surface. The same effect may be produced by mulching, or by covering the surface with sand.

With the aid of deep tillage it is often possible to raise on salty sea-shore lands root crops, such as beets or carrots, which absorb a large amount of soluble salts and sensibly relieve the soil, so that cereal crops may be grown the second or third year.

2. Underdrains may so far lower the water-table from which the saline matters are derived, and may so far favor the washing out of the salts during the rainy season, that the latter will thereafter fail to reach the surface so as to accumulate to an injurious extent with reasonably deep tillage. The roots of plants will go deeper for the requisite moisture, but will not be injured by the weak saline water below. With the aid of underdrains, in many cases a comparatively small amount of irrigation water may, when applied at the proper time, be made to produce the leaching effect upon the surface soil that would otherwise require a long time and a much larger quantity of water in order to wash the alkali into the country drainage.

3. When the quantity of the salt or alkali is small, but its nature such as to be nevertheless very injurious or corrosive, the evil may be greatly mitigated, or sometimes completely relieved, by the application to the soil of chemical antidotes, cheaply procurable in commerce. In order that the proper antidote may be chosen, it is of course necessary to determine the nature, and, in a measure, the amount, of the "alkali" by chemical analysis. The salts usually found in the California "alkali" soils, so far as they have come under my observation, are of three kinds:

a. Neutral alkaline salts, such as common salt, Glauber's salt, sulphate of potassium, etc. These are injurious only when present in large quantities, and relief can then be obtained only by washing them out of the soil by flooding, underdraining, etc.

b. Soluble earthy and metallic sulphates and chlorides, such as Epsom salt, bittern, chloride of calcium, alum, copperas, etc. The cheap and efficient antidote to these substances is lime; in some cases even a natural calcareous marl will answer the purpose.

c. Alkaline carbonates and borates. These, especially the former, are injurious in the smallest amounts, rendering the soil-water caustic and corrosive, and in clayey soils rendering it almost impossible to obtain good tilth, by their peculiar action upon the clay. They are most abundant in southern California, while the second and first class seem to prevail in the Sacramento valley.

The antidote to these, the true alkali salts, is gypsum or land-plaster. The efficacy of these antidotes depends, of course, upon the presence of water, without which they cannot act on the "alkali". They should be sown or spread on the surface and plowed or harrowed in to a moderate depth just prior to irrigation, where that is used; in the case of plaster, put in with the grain; in that of lime it should be put in just before a rain, or irrigation, and not at the same time with the grain or other seed. The amounts to be used of either of these substances will, of course, depend altogether upon the quantity of alkali in the soil and upon the amount of surface evaporation allowed in cultivation. It therefore varies and must be ascertained by experiment or analysis in each individual case. Their effect is to convert the corrosive or otherwise injurious salts into "neutral" ones, such as Glauber's salt or common salt, which are from ten to twenty times less injurious than, *e. g.*, the carbonate of soda. It follows that, when soils are very highly charged with the latter substance, even its conversion into neutral salts may not suffice to render the soil capable of profitable culture. To effect this it may be necessary to aid the antidote by leaching-out in bad cases. On the other hand, the antidote will, in any case adapted to its use, aid either of the other methods of obtaining relief. The farmer afflicted with alkali should, therefore, not feel discouraged or disposed to condemn as useless any one of the measures of relief here described simply because the result is not perfect. The three should be combined, wherever possible, to the extent justified by the pecuniary value of the land.

In districts afflicted with the carbonate of soda in the soil it has been found in numerous cases that the simple use of gypsum, conjointly with summer tillage, to keep the soil loose has sufficed to enable land that never before produced anything of value to bear abundant crops. But the failure to secure a similar result in the neighboring fields, at times, has caused unnecessary discussions as to the utility of gypsum. It should be remembered that where the amount of soluble salts present in the soil is very large gypsum may mitigate, but cannot altogether relieve, the trouble; its action must be supplemented by other means calculated to remove the soluble salts from the soil. In case carbonate of soda should not be present, gypsum will effect no improvement at all. To ascertain this is not at all difficult. The presence of carbonate of soda or potash is generally indicated when the water standing on the low alkali spots is of a dark-brownish tint, from the dissolution of the vegetable matter or humus of the soil; in other words, it is what is popularly known as "black alkali". Such alkali will, moreover, impart a brown tint to paper dyed yellow with turmeric, or it will turn the juice of red cabbage green, or the color of blue litmus paper red. Again, if water be shaken up with gypsum and allowed to settle, and some of the clear alkali water added, the gypsum water will be rendered turbid.

Analyses of "alkali".—The accompanying table shows in detail the composition of "alkali" salts occurring at different points in California.

Table showing in detail the composition of "alkali" salts occurring at different points in California.

Locality.	Soluble salts in 100 soil.	Potassium sulphate.	Potassium carbonate (saleratus).	Potassium chloride.	Sodium sulphate (Glauber's salt).	Sodium carbonate (sal-soda).	Sodium chloride (common salt).	Sodium borate (borax).	Sodium nitrate (saltpeter).	Sodium phosphate.	Calcium phosphate (bone earth).	Calcium sulphate (gypsum).	Magnesium sulphate (Epsom salt).	Magnesium chloride (bittern).	Organic salts of lime and magnesia.	Organic matter.	Silica.	Total.	Antidote.
Corvallis, Los Angeles county	1.68	8.74	....	....	51.19	.....	22.37	.....	.....	.....	0.51	.....	.....	.....	.....	.....	.....	82.81	Drainage.
Westminster, Los Angeles county	0.49	20.62	6.59	....	.....	61.48	10.57	.....	.....	.....	.....	.....	.....	.....	.....	.....	....	99.26	Gypsum.
Anaheim, Los Angeles county	.....	.....	....	....	.....	.....	(‡)	.....	(*)	.....	.....	(‡)	(*)	.....	.....	.....	.....	.....	Drainage.
Riverside, San Bernardino county	.....	.....	....	(*)	77.45	0.69	22.17	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	100.31	
Merced bottom, No. 18, Merced county.	.....	.....	....	....	(*)	(†)	(*)	.....	.....	.....	.....	.....	.....	.....	(§)	.....	.....	.....	Gypsum.
Merced bottom, No. 19, Merced county.	1.00	.....	....	....	3.88	63.09	1.21	.....	10.72	4.10	.....	.....	.....	.....	.....	17.01	.....	100.01	Do.
San José, Santa Clara county	14.70	.....	2.92	....	75.98	14.59	6.79	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	100.28	Do.
Benton, Mono county	.....	.....	....	....	(‡)	(†)	(‡)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Do.
Sherman island, Sacramento county.	.....	.....	....	0.19	.....	.....	5.94	.....	.....	.....	.....	.....	93.17	.....	.....	.....	.....	99.30	Lime.
Curtis' ranch, near Stockton	3.73	.....	....	....	75.85	6.97	16.38	.....	.....	1.18	.....	.....	.....	.....	.....	.....	.....	100.38	Gypsum.
Overhiser's alkali soil, Stockton	0.15	.....	....	....	13.26	52.74	33.08	.....	.....	1.83	.....	.....	.....	.....	.....	.....	.....	100.91	Do.
Overhiser's alkali soil, Stockton	1.02	.....	....	....	22.92	64.01	13.06	.....	.....	(*)	.....	.....	.....	.....	.....	.....	.....	100.00	Do.
Hueneme, Ventura county	.....	5.64	....	....	42.50	.....	22.10	.....	.....	.....	.....	2.49	25.61	0.75	.....	.....	.....	99.09	Lime, drainage.
Goshen, Tulare county	1.40	.....	....	....	44.24	32.98	16.74	.....	.....	1.97	.....	.....	.....	.....	.....	1.57	.....	97.50	Gypsum, drainage.
Mojave, Los Angeles county	.....	.....	0.58	....	35.38	12.03	31.48	.....	.....	0.92	.....	.....	.....	.....	.....	18.88	0.73	100.00	Do.
Colton, San Bernardino county	.....	.....	....	....	26.73	53.08	12.28	.....	.....	0.60	.....	.....	.....	.....	.....	7.10	0.21	100.00	Do.
People's Ditch, Tulare county	.....	.....	....	....	1.22	88.09	1.00	.....	.....	.....	.....	.....	.....	.....	.....	9.21	0.48	100.00	Gypsum.
Sumner, Kern county	.....	.....	....	....	19.20	.....	37.14	.....	.....	.....	.....	0.96	18.31	.....	.....	20.87	.....	96.48	Drainage, lime.
Dos Palmas, San Diego county	.....	.....	....	....	29.60	.....	29.44	.....	.....	.....	.....	0.77	1.25	12.34	.....	23.67	2.92	99.99	Lime, drainage.
Lemoore, Tulare county	.....	.....	....	....	(†)	.....	(*)	.....	.....	.....	.....	(*)	(¶)	.....	.....	.....	.....	.....	Drainage.
Emigrant Ditch, Fresno county	.....	.....	....	....	.....	(†)	(*)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Gypsum.
Collinsville, Solano county	.....	.....	....	....	(‖)	.....	(‖)	.....	.....	.....	.....	.....	(†)	.....	.....	.....	.....	.....	Lime.
Skagg's Springs, Sonoma county	.....	0.12	....	0.97	.....	78.54	2.95	12.90	trace	Li Co 3 0.03	Ca Co_3 1.08	.....	Mg Co_3 0.54	Sr Bd Co_3 0.13	.....	.....	3.42	100.68	Gypsum.

* Little. † Chiefly. ‡ Much. § Large. ‖ Some. ¶ Moderate.

A point of great importance to the agriculture of these regions appears from even a cursory inspection of the table, viz, that in many cases phosphates, nitrates, and potash salts form a notable proportion of the "alkali". These are the substances of which the withdrawal by cropping causes sterility of the soil, and the purchase of which forms a standing item of outlay in the farmers' accounts wherever a regular system of husbandry is established. Ordinarily they are found only in traces in the water permeating even the richest soils, the amount present being so small, or in such a condition of insolubility, that they are retained in the soils; but here we find them to be present in such large proportions as to form a regular part of the circulating soil-water, the inference being that such soils, when freed from the injurious portions of the "alkali", would be extraordinarily productive, and would remain so permanently, without any additional supply of manure, if it could be assumed that soil-water of similar composition would continue to ascend from below. But even if this should not happen, the amounts shown to be actually present in a soluble condition are far from insignificant in themselves, apart from their pointing to some prolific source of the supply. Taking, for instance, the case of Overhiser's "alkali" soil in the above table, we find that the apparently insignificant percentage of soluble phosphates, when calculated to percentage of the total soil (0.0064 per cent. of phosphoric acid), amounts in absolute weight per acre of soil taken 12 inches deep and weighing about 3,750,000 pounds to no less than 240 pounds, a quantity which, being absolutely available to crops, would, *e. g.*, suffice for sixteen crops of wheat of 25 bushels to the acre; or, expressed differently, it is equivalent to a ton of best commercial superphosphate, for which $45 would have to be paid. At least an equal amount must, moreover, be estimated to be present in the soil in the ordinary condition—mechanically absorbed and insoluble in water, yet available to plants. Hence, the above estimate of wheat crops, for which the soil contains an immediately available supply, must be at least doubled; and after that is exhausted there would still probably remain a supply as great as is ordinarily present in soils.

It should be noted that, in the case of these phosphates, the addition of gypsum would permanently prevent their being washed out of the soil, even in case the leaching-out process were to be resorted to; yet their availability to vegetation would not thereby be impaired. It is highly probable that in many cases where phosphates have not been determined by the analysis their presence has simply been overlooked, and that their occurrence is much more general than is now proven. The amounts of potash found in some of the "alkali" salts are so great as to justify the conclusion that the supply of this ingredient in the corresponding soils is practically inexhaustible; for the fact that they circulate in the soil-water proves that the soil must in the first place have been fully saturated with them, apart from what is actually in solution, and that in all probability the supply comes from the permanent water-table. To this extent the cultivators of such soils would be permanently relieved from the necessity of replacement by manure.

As regards the nitrates, it is obvious that they are locally formed in considerable amounts in the arid regions of North America as well as in that of Bolivia. Minute quantities can be detected in almost all cases in which the carbonates of sodium or potassium form a large proportion of the soluble salts, but it is only under exceptional circumstances of location and rainfall that they can accumulate to

a notable extent. Such is the case of the alkali tract in the bottom of the Merced river from which specimen No. 19 was taken. It lies in a local basin of impervious limestone, and forms a low ridge, which is only exceptionally overflowed by the river, and that after previous rains, so that even the salts that have bloomed out on the surface are not usually washed away.

It is quite probable that in the cultivation of regions possessing a climate suitable to the generation of niter deposits the artificial addition of the latter as a commercial manure will rarely be necessary. Since nitrates are not retained in a soil percolated by water, the use of drainage or leaching-out of the soluble salts will result in the removal of this important fertilizing ingredient from the soil. When known to be present, therefore, the process of washing out should not be carried further each season than is needful for the success of crops, and all the means mentioned for reducing the injurious effect of the corrosive salts on the crown-roots should be employed. It goes without saying that in each case crops adapted to the particular circumstances will, other things being equal, bring the best returns. Experience has already in many cases demonstrated the extraordinary productiveness of some "alkali" lands when reclaimed by the means described.

Effects of irrigation on alkali soils.—During the past two or three years complaints of the increase of alkali on irrigated lands in the upper part of the San Joaquin valley, especially in the counties of Kern, Tulare, and Fresno, south of King's river, have become more and more frequent. During a personal examination of that region in March, 1880, this important matter was brought prominently to my notice by many farmers. Much difference of opinion prevailed as to the causes of the evil, but there was no question as to the fact of the increased "rise of the alkali".

The latter phrase, commonly used in this connection, really contains the clew to the whole problem. It is emphatically true that the alkali salts rise from below, through the agency of the water evaporating upon the surface. Irrigation has not only increased the amount of water evaporating from the surface, but it has also caused a much greater depth of subsoil to be drawn upon for its alkali. That in many cases the strata lying at depths of from 4 to 6 feet from the surface are much more highly charged with soluble salts than the surface soil is painfully apparent from the aspect of the material thrown out in digging the irrigation ditches and now lining the banks of the latter. In some portions of the "island" embraced between the several outlets of Kern river south of Bakersfield these embankments appear as though covered with snow, and the alkali can be bodily picked up by the handful. It would seem as though the rains would have leached these earth-piles long ago, but the rains usually falling in that region are so light that the soluble salts are only washed into the soil to a few inches from the surface, and within a few days after evaporation has again brought them back in the shape of a white crust. In digging wells in the light sandy soils of the "plains", from King's river southward, it has often been found that no perceptible moisture existed, even at the depth of from 20 to 40 feet, until after the region had been irrigated here and there for several years. The amount of water needed is at first very large, but when the soil is once filled down to the drainage level one-half and even one-third of the water previously used will suffice to grow a grain crop.

The rainfall in this region is usually so small (from 4 to 8 inches) as to suffice only for moistening the soil to the depth of a few feet, and during the time required for the evaporation of this natural moisture the short-lived vegetation of the region rapidly passes through its development. That vegetation consists of a comparatively small number of species of bright spring flowers, which in their season cover the entire country with a dense and beautiful carpet, one and the same flower occupying the ground almost exclusively at times for many square miles by virtue of the law of the "survival of the fittest". Were there any crop of a habit similar to these flowers that could be profitably grown on these plains irrigation could obviously be dispensed with. The settlers of the region have tried what seems to be the next best thing, viz, to grow grain crops of a short period of growth, and therefore needing irrigation only during a small portion of the dry season. In so doing they have moistened the soil to a considerably greater depth than was reached by the rain-water before, and, as a consequence, the annual evaporation has greatly increased. The irrigation water, moreover, has brought with it from these depths all the supply of alkali salts that before had gradually been washed beyond the reach of the ordinary rainfall by an occasional wet season. Each succeeding irrigation, followed by evaporation, tends to accumulate the salts nearer the surface, so that finally the root-crowns of the grain crops are "burnt up" before even beginning to head. The evil will, of course, be greatly aggravated if the water used for irrigation originally contains any considerable amount of alkaline salts, which are superadded to those already in the soil strata. Some important practical bearings of this point will be discussed further on.

Remedies for the "rise of the alkali".—It is obvious that the "rise of the alkali", following upon irrigation, cannot be remedied by the use of the chemical antidotes alluded to above. While they do convert the most injurious salts, carbonate of soda and sulphate of magnesia, into much less active compounds, yet these will remain in the soil, and if in sufficient quantity will ultimately become noxious, especially to shallow-rooted vegetation. In some districts afflicted the natural alkali consists only of such "neutral" salts as common and Glauber's salt; as, for instance, in a part of the rich Mussel Slough country around Hanford, Tulare county, where at the time of my visit dead spots were appearing in the magnificent grain-fields when the grain was but a few inches high, the evil being worse wherever the crop was late and had not yet shaded the ground. Moreover, it was obvious and strikingly worse wherever the soil was sufficiently clayey to form a hard crust on the surface; a fact well known and recognized by farmers in the alkali regions, but often ascribed simply to the constriction of the stems by the contracting crust. The effect of the latter may, it is true, be noticed in adobe districts, where there is no alkali, and undoubtedly bears its share in doing damage; but the injury it creates is doubly great in alkaline soils.

In the early stages of the growth of cereals the pulverization of this crust may be accomplished by harrowing or rolling, with great benefit to the crop; but in the upper valley it can rarely be done after the last irrigation without considerable mechanical injury. That a soil having such a surface crust dries much more rapidly than the same soil when kept in good tilth is a fact too well known to require discussion. The dense crust absorbs water much more powerfully than does the loose soil beneath. The moisture is forcibly drawn from the latter into the surface crust, and there evaporates quickly under the influence of air and sunshine, hardening the crust more and more, and accumulating therein an increasing amount of alkali. To illustrate this, imagine a sponge, representing the loose soil, to be saturated with water, and a hard-burnt brick, representing the crust, to be laid upon it; the brick will take all the water from the sponge. Yet, if the brick be soaked in water and the sponge pressed on it, the sponge will not take up a particle of moisture. It is thus obvious that in alkaline soils the formation of a surface crust must of all things be avoided. In other words, as stated above, "deep and frequent tillage" is one of the foremost needs in such soils. And as this condition cannot be fulfilled in the case of broadcast crops, the conclusion is that broadcasting, and with it practically grain-growing, must ultimately be abandoned in the alkali regions and hoed crops substituted, which will admit of the ground being kept in perfect tilth throughout the season.

Crops for alkali soils.—The condition of preventing evaporation from the surface is also measurably fulfilled by such crops as "alfalfa", which not only thoroughly shades the ground, but in addition causes almost the entire evaporation water to pass up through its deep roots to the leaves, so as not to reach the surface at all. Such accumulation of alkali in and around the roots as can occur under such circumstances is too much diluted to hurt the plant. The fact that the alfalfa succeeds perfectly on ground too much charged with alkali to grow grain is notorious, only care must be taken to prevent injury to the root-crowns while the plants do not yet cover the surface by timely irrigation.

If circumstances permitted the profitable cultivation of alfalfa on so large a scale, the alkali districts would perhaps have little cause to seek further. The experience with alfalfa, however, clearly points the way for the selection of crops better suited to the circumstances than grain, whose shallow roots are much more liable to alkali corrosion than is the case with the tap-rooted or other deep-rooted plants. It is among these, then, that the alkali regions should seek for crops of which the product shall be sufficiently valuable to bear the expense of inland transportation, under which these districts are now suffering. Next to these, the search should be for such as will be successful in alkali lands, provided the soil be kept well tilled through the dry season, *i. e.*, "hoed" crops.

In the former category, one of those standing foremost in promise is probably *cotton*, the success of which in that region is already shown by experiments made, the profitable production being at present limited only by the demand for the staple on this coast, which may soon be increased by the establishment of cotton factories. Of other textile crops, hemp, jute, and ramie at once suggest themselves for trial.

Of oil crops, the castor bean is perhaps the most available and most certain of success, always excepting the despised "white mustard" or "wild turnip", whose rank growth as a weed shows what might be done with it if grown for the manufacture of rape-seed oil. Root crops, being too bulky for profitable shipment by rail, will not be available to any great extent at present unless as dairy feed, in conjunction with alfalfa, for conversion into butter and cheese; but beets, carrots, turnips, sweet potatoes, etc., all fulfill, to a greater or less extent, the conditions above formulated for successful culture in alkali soils. The culture of fruits, both large and small, that can be shipped in the dried condition, or in the shape of jellies, etc., is also an available industry, scarcely yet touched in the alkali regions. Raisins and prunes especially deserve attention as pretty certain of success.

Among hoed field crops available for that region sorghum and sugar-cane deserve attention. It is true that in general the presence of a large supply of soluble salts in the soil is deemed unfavorable to the profitable production of sugar, since it is apt to render the juice difficult to crystallize and to increase correspondingly the proportion of molasses produced. Actual trial, however, can alone determine the question here.

It would really seem as if, in the broadcast culture of cereals, the farmers in the alkali districts had made the worst possible selection for the permanent good of agriculture in their region. That a change of system in this respect is imperative can hardly be questioned by any candid observer of the facts. And it may well be questioned whether the necessity imposed by nature, of more varied and careful farming than has heretofore obtained, may not prove a blessing in disguise when rightly understood and acted upon. The planting system enriches a few individuals, almost always at the cost of the soil's permanent productiveness. It is small farms and intelligent culture that constitutes the prosperity of an agricultural community.

Sub-irrigation vs. Surface irrigation.—The injury arising in alkali lands from the formation of a consolidated surface or crust subsequent to irrigation by flooding suggests at once the application of the water in such a manner as to avoid this evil, viz, by sub-irrigation. To a certain extent the advantage so secured is well understood in the irrigation districts, the water being often applied only by the use of furrows or ditches, which divide the land into narrow bands, and from which the soil is moistened by "soaking sideways" from the ditches. The great multiplication of the latter, and their interference with the operations of culture on the large scale, have generally caused the use of this mode of irrigation to be restricted to small cultures. Even a cursory inspection of the state of things in the alkali regions shows that in the plots sub-irrigated by ditches the rise of the alkali has, as a rule, been very much less than in the case of adjoining ones irrigated by flooding; and, in the latter, the high spots that have not been covered with water frequently escape damage, while the low portions are scorched with the alkali. This, at least, is the result when the amount of alkali present is not very great. When the soil is very heavily charged, the high spots, being the first to dry, are also the first to be injured by the alkali drawn to the surface by evaporation, while in the low spots the grain may reach a greater development before being killed. Manifestly the object to be attained is to prevent the irrigation water from reaching and evaporating from the surface at all, if possible. To accomplish this fully it would be necessary to know how far upward water will rise when applied to the several soils. Some data concerning this point are given in books on agricultural science, but they are not of such a character as to permit the prediction of this measure with respect to any other given soil. We know in general that in coarse, sandy soils water rises rapidly, but only to a moderate height, stopping there; while in soils composed of fine materials, whether clay or fine silty matter, or both mixed, the rise is slow, continuing for months in some cases before reaching the highest point, which may, however, be twice or three times as much above the water surface as in the case of sandy soils. For instance, in coarse, sandy soils, like those of portions of the plains of Tulare or of parts of Stanislaus, the water may, in the course of three or four days, reach its highest point at 20 inches; while in adobe soils, or in the gray silt soils of Eel or Santa Clara rivers, it may take ten days to reach the same height, but will continue to rise slowly for several months before reaching the maximum height of about 50 inches.

The coarse sandy soil represents not only its kind, but also any well-tilled soil; while, on the other hand, the adobe soil illustrates the case of any compact soil, whether naturally so or rendered so by imperfect tillage or the prevalence of carbonate of soda. The extreme slowness of the ascent of the water toward the end of its possible rise shows why a poorly-tilled adobe soil will open into gaping cracks a short time after the cessation of rains; while a well-tilled soil, maintaining both a quicker supply from below and a slower rate of surface evaporation, may maintain moisture throughout the dry season. At the same time it informs us that sandy soils stand in especial need of a more dense subsoil, capable of drawing up moisture from greater depths than it is possible for a sandier mass to do, thus supplying moisture to the roots of plants, while allowing but little surface evaporation. As between the same soil in a state of tilth or such compactness as would result from packing by heavy rains, experiment has shown that the rate of ascent is in clay soils easily reduced to one-half or even less.

The many and somewhat complex bearings of this subject on the chief varieties of soils in the alkali region will form the subject of farther investigation, now in progress. One point, however, may even now be usefully discussed, viz, that while it is certain that water applied to a coarse sandy soil, at the depth of 24 inches, cannot reach the surface at all, and can, therefore, evaporate but very slowly, and not in such a manner as to accumulate alkali to an injurious extent near the surface, it does not, therefore, follow that in order to produce the same result in the adobe or silt soils the water has to be applied at the maximum depth of 50 inches; for in a field planted with any growing crop the leaves of the latter evaporate a very large amount of moisture, thus intercepting that which would otherwise rise to the surface and evaporate there. This is a matter of every-day experience. The inference is, that ditches or pipes designed for sub-irrigation would not in such soils require to be laid to any unreasonable depth in order to prevent the rise of alkali resulting from surface evaporation.

It is obvious that in this connection the subject of sub-irrigation by means of a system of pipes, of whatever material, acquires exceptional interest for the alkali districts, since its judicious use would not only obviate the rise of the alkali, but would also accomplish a great saving of irrigation water—the latter being a matter of especial importance where the water itself is somewhat tainted with alkaline salts. That this system is not likely to be used in connection with the growing of field crops on a large scale is true, since the expense of the pipes is too great for any land not yielding very high returns; but when the continued rise of the alkali renders lands, intrinsically fertile, incapable of further production under the system of surface irrigation, the owners will needs have to take their

choice between its abandonment and the adoption of such systems and objects of culture as will yield them profitable returns under the circumstances. The culture of cereals must "go to the wall", and that of grapes, fruits, and such other crops as can be made to yield high returns under intense culture must take its place. It is not, perhaps, unreasonable to hope that the improperly so-called "asbestine" sub-irrigation pipe (consisting of hydraulic cement pipe, that can be cheaply and rapidly laid by a special appliance, at an expense not exceeding, it is said, $35 per acre) may become so generally available by the home manufacture of the material as to form a practical solution of this great problem.

It should not be forgotten that, with a slight change in the manner of laying and outletting, this sub-irrigation pipe may be made to serve also for underdrainage; so that land provided with it could be completely leached of its surface alkali by flooding during the season when water is abundant.

LAKE AND RIVER WATERS OF THE GREAT VALLEY, AND THEIR QUALITY FOR IRRIGATION PURPOSES.—In the foregoing discussion of the "alkali" question it has been tacitly assumed that the soluble salts already in the soil alone need to be considered, the water used in irrigation being regarded as pure water only. This, however, is far from being actually the case with any natural water, and in the alkali districts especially the irrigation water is almost always more or less impregnated with the very same salts whose presence in the soil is so objectionable. It is obvious that, when the amount of salts so added annually is at all considerable, it may ultimately so swell the quantity in the soil as to give rise to trouble. My attention was first directed to this subject by reports from the lands bordering upon Tulare lake to the effect that, although to all appearance of the best alluvial character, they would either not produce at all from the outset, or else would cease to produce after a few years when irrigated with the water of the lake. The beginning of the investigation of this subject was given in the report of the California College of Agriculture. A soil from the southeastern corner of the lake had been analyzed and found to contain in abundance all the elements of fertility; yet it would produce nothing, and that under circumstances which led me to believe that the trouble was caused by alkali (carbonate of soda) contained in the soil. Analyses seemed to confirm this supposition, but at the time the report went to press the water of Tulare lake itself had not been examined. Water samples were soon afterward received and analyzed, and the result showed it to contain so much alkali of the most corrosive character as to render it utterly unsuitable for irrigation. It then became apparent that one of the great bodies of water in the state that had been counted upon for irrigation purposes might have to be altogether rejected. The importance of the question led me to make the matter the subject of special inquiry during a visit to the upper valley, made under the auspices of the United States census, in March of the present year.

A personal examination of Kern lake, and of the region lying between it and Buena Vista lake, as well as of the Mussel Slough country, in Tulare county, satisfied me that in none of these rich agricultural sections could the slightest increase of alkali be safely risked; and analyses subsequently made of the waters of both Kern and Tulare lakes prove that a very few years' use of the water now filling either of these reservoirs would be promptly fatal to the productiveness of the lands irrigated. As regards Kern lake, this is obvious enough from a casual examination and tasting of the water. Having been shut off from the natural influx of Kern river for a number of years, it has been rapidly evaporating and receding from its former shores, so that at the time of my visit a difference in level of over four feet had been produced in fifteen months, leaving high and dry a boat wharf built at that time. About eighteen months before all the fish and turtles in the lake had suddenly died, creating a pestilential atmosphere by their decay, and even the mussels were mostly dead, a few maintaining a feeble existence. A strong alkaline taste and soapy feeling of the water fully justified their choice of evils. The tule marsh, laid dry by the recession of the lake, was thickly crusted with alkali, and the tules were dead, except where still moistened by the water of the lake, showing that the latter was not yet too strong for such hardy vegetable growth, albeit fatal to animal life.

Buena Vista lake was stated to be in a similar condition, but not yet quite so far advanced in evaporation, and still maintaining some animal life in its waters, having lost its connection with the river more recently. Tulare lake is well known to be full of fish, and as it annually receives the overflow of Kern and the regular inflow of King's river its evaporation and recession has been much slower; yet its water's edge is now distant several miles from the former shore-line, and as the water of the rivers is more and more absorbed by irrigation it will doubtless continue to recede until a point is reached at which the regular seepage from the irrigated lands will balance the evaporation. This epoch would seem, however, to be quite in the future as yet, for the rate of recession has, apparently, not sensibly changed in the last few years.

It is not likely in any case that the water of the lake will be more abundant or less impregnated with mineral matter than is now the case at the time when the state of equilibrium shall have been reached. In order to assure a fair determination of this important point water samples from the opposite ends, as well as from the middle of Tulare lake, have been analyzed, with the results given below. The sample of Kern lake water was taken by myself on the north shore of the lake, March 24, 1880. Tulare lake water No. 1 was taken about 300 yards off shore, near the southeast corner of the lake, inside of Root island, near land lately reclaimed by Mr. E. R. Thomason, of San Francisco. Samples Nos. 2, 3, and 4 were taken, according to my directions, near the middle of the lake, under orders of the King's River Canal and Irrigation Company, respectively at the surface, at 10 feet depth, and at 20 feet depth. Of these, only one (No. 3) was fully analyzed, the total of solid contents only being determined in the case of the others, whose composition could not, of course, differ in any material respect. No. 5 is water taken by Mr. E. Jacob, of Visalia, at a point off the mouth of Mussel slough, in the estuary of King's river, March 28, 1880. The sample was taken from the surface at a time when a strong northwest wind prevailed, which of course had a tendency to bring a larger admixture than usual of the fresh water of King's river.

Composition of the waters of Kern and Tulare lakes.

[Grains per gallon.]

	Total residue.	Carbonate of soda	Common and Glauber's salts, etc.	Carbonates of lime and magnesia, and silica.	Vegetable matter.
Kern lake	211.50	64.37	115.41	9.29	22.43
1. Tulare lake, south end	81.49	27.92	37.85	13.44	2.28
2. Tulare lake, middle, surface	81.95	35.30	35.96	5.37	5.32
3. Tulare lake, middle, 10 feet below surface	81.83	36.46	39.49	7.47	4.41
4. Tulare lake, middle, 20 feet below surface	81.72				
5. Tulare lake, near mouth of King's river	38.55	13.46	15.01	5.11	4.97

To convey to those unaccustomed to the consideration of such matters an idea of the meaning of the above figures, it may be stated that the solid contents of river waters vary usually from 5 to 12 grains per gallon. The water of Tulare lake, where it is undiluted by the inflow of King's river, is therefore about ten times, and that of Kern lake about twenty-six times, stronger than an average river

water. Even this, however, conveys but an inadequate idea of the relation sustained by these waters to organic life. The average sea-water (containing mainly common salt) is about ten times stronger than the water of Kern lake as regards its solid contents; yet in sea-water fresh-water fish live freely during part of the season, while in Kern lake the fish died at a time when, according to a minimum estimate, the water must have had about twice the strength of Tulare lake, or about one-thirteenth of the strength of sea-water. This shows strikingly the deadliness of the Kern lake alkali as compared with sea salt, or, in other words, of Kern lake water as compared with tide-water.

In comparing the quality of the alkali of Tulare lake with that of Kern lake we find that in the former the proportion of the carbonate of soda (being the chiefly injurious ingredient) is about 1 to 2.83 of the whole solid contents, while in the latter this ratio is 1 to 3.28.

A part of this difference is, however, due to the large amount of vegetable matter dissolved in the strong lye filling Kern lake; and, when allowance is made for this, the ratio becomes nearly the same in both waters.

As regards the relation between common and Glauber's salt on the one hand and carbonate of soda on the other in these several cases, it appears that in the evaporation process there is a gradual relative decrease of the carbonate of soda, for we have for this ratio:

Locality.	Carbonate of soda.	Common and Glauber's salt.
Tulare lake, near mouth of King's river	1	1.11
Tulare lake, middle	1	1.29
Tulare lake, south end	1	1.35
Kern lake	1	1.78

Whether this change in composition arises from a chemical change of the carbonate of soda or from an actual accession of the other salts is not easy to determine. The latter is the more probable explanation, inasmuch as actual veins and strata, several inches thick, of what from the description appears to be mainly Glauber's and common salt have been found in the region between Tulare and Kern lakes in digging ditches. But whatever may be the cause of this slight difference in the composition of the alkali in the different portions of Tulare lake, that difference is not sufficient to invalidate the broad conclusion that the water of that lake, as at present existing, is unfit for any of the ordinary processes of irrigation.

To prove this it is only necessary to consider what is the amount of the alkali that, under the usual practice, would accumulate near the surface. Ten inches of water is the usual estimate of what is needed in the course of the year to perfect a crop. Now, 1 gallon of water will cover about 1¼ square feet 1 inch deep, or two-thirds of a gallon 1 square foot, or 6⅔ gallons per square foot is equal to 10 inches depth of water. Assuming the average solid contents of lake Tulare water at 80 grains per gallon, this quantity, upon evaporation, will leave near the surface, upon each square foot irrigated, 533 grains, or about 1⅛ ounces of alkali. This amount, pulverized and strewn over the surface, would cover the whole of it thickly with a white deposit—a phenomenon already but too familiar to the farmers of that region. That the operation could not with impunity be repeated many years on any soil, least of all on such as are already more or less charged with alkali, scarcely requires discussion.

To illustrate the latter point, a tule soil, taken by Mr. E. Jacob, of Visalia, from his land near the mouth of Mussel slough, was leached with water to ascertain the amount of alkali present. This was found to be 0.32, or about one-third of 1 per cent. Of this, supposing it to be of the same composition as that found in the water of the lake, about three-eighths, or, otherwise expressed, one-eighth of 1 per cent. of the whole soil is carbonate of soda, amounting to over 2 ounces in each cubic foot. This is within the limits of endurance of ordinary vegetation, at least in so fertile a soil; but double or triple it by evaporation, and that limit is passed.

To this conclusion, nevertheless, it is objected by some that the borders of Tulare lake are thickly edged with vegetation in many places, and that in some cases garden plots have been successfully irrigated with the lake water for several years. One such case is reported by Mr. Jacob, of Visalia, who took sample No. 5 of the table of analysis from the mouth of a small canal serving for the irrigation of a vegetable garden, which was doing well at the time. A few other similar cases have been mentioned to me. These, however, do not invalidate at all the conclusion that the lake water cannot serve for general irrigation as usually practiced. Even the strongest water in the lake, near its southern end, is not so strong as to injure the roots with which it comes in contact so long as it is not concentrated by evaporation. But in the low tule lands thus far tried this cannot occur to any great extent, on account of the constant presence of surplus water and the frequently repeated irrigation, by which the strength of the alkali in the soil is kept below the point of injury. It would be quite otherwise where the same water, used sparingly two or three times during the season, would evaporate so as to accumulate all its alkali near the surface; yet it is probable that if the soil so irrigated were to be leached by a very copious and continued flooding once a year, so as to carry the accumulated alkali into the underground drainage, the water might be used with impunity. This would be especially the case with land underdrained, and could be more readily accomplished the smaller the amount of water originally used. The minimum amount, undoubtedly, would be the outcome of pipe sub-irrigation, and would be applicable to the case of orchards, vineyards, etc. It might even be possible in some cases to make the same pipe system serve the purpose of irrigation at one time and that of underdrainage at another; but, in whatever way accomplished, a leaching-out of the alkali, accumulated from evaporation of such waters from time to time, would be a necessary condition of their continued use for irrigation purposes.

This principle applies, in fact, to many more cases than is ordinarily supposed. Irrigation, without proper provision for drainage, has in the past, in very many cases, been the cause of the abandonment of lands, once abundantly fruitful, which were supposed to be exhausted by culture, but in reality had simply become overcharged with injurious salts, or alkali, from the ever-repeated evaporation of enormous quantities of water, whose solid contents, though naturally very small, had nevertheless been too strongly concentrated in the soil. This naturally leads us to the consideration of the river waters of the San Joaquin valley and their relation to the origin of the alkaline character of the waters and soils of the upper valley.

Geological history of the valley of California.—That the great valley of California was in remote (Quaternary) times a great inland lake, which disappeared in consequence of the breaking through, first, of Carquines straits, and afterward of the passage of the Golden Gate, is a matter scarcely doubted even by the casual observer. A glance at the map also shows that, from some cause not yet fully understood, there exists in the southern part of Fresno county a ridge across the valley by which the waters of King's river are thrown southward into Tulare lake. At present this ridge is intersected at its western end by Fresno and other sloughs, through which the surplus waters of Tulare lake or of King's river can find their way into the San Joaquin. But previous to the formation of this outlet

the entire upper valley evidently was a shallow lake, of which Kern, Buena Vista, and Tulare lakes are the remnants. From the data given below, it appears certain that the entire lake of the great valley had a somewhat alkaline water; and they also show that probably the residuary lake of the upper valley was more strongly so at first, and rendered more so in the course of long periods of evaporation, during which "sheets of alkali" (to use the language of the workmen who dug the Kern canal) were formed among the alluvial deposits of the western margin of the valley.

It is only thus the fact already alluded to, viz, that the deeper portions of the Kern valley alluvium are most strongly impregnated, can find its explanation. Whence did all the alkali come? A partial answer to this question is readily found in the frequent "blooming out" of soluble salts on the face of hillside cuts. Evidently a good deal of such salty matter pre-exists in the geological strata of the valley, and must be continually washed out by percolating water, which carries it into the lower portions of the country, and finally into the lakes themselves. But it would be difficult to account for the large accumulations of these salts in the Kern valley if there were not some more copious and lasting source. For this we would naturally look to Kern and King's rivers themselves, and analyses of the waters of these rivers were accordingly made, with the results given below.

Analyses of waters of the great valley.—At my suggestion, an investigation of the waters of the chief rivers entering the valley between King's river and the Sacramento was undertaken by Mr. Horace G. Kelsey, of Merced Falls, as a graduating thesis at the University of California. This includes the results given below under Nos. 12 to 15, both inclusive. The analyses of the water of the Sacramento and Los Angeles rivers were made for the state board of health by Mr. Walter Jones (of the class of 1878, University of California) and published in the report of that body for the year 1878. To facilitate comparison, the table includes again the analyses of the lake waters already given above, and also an analysis of the water found a few feet beneath the surface at Point of Timber, Contra Costa county, near the junction of the San Joaquin and Sacramento, in such abundance as to suggest its use for irrigation.

No. 1. Water from Los Angeles river, taken from a hydrant in the city of Los Angeles, September, 1878.

No. 2. Water taken from the grand cañon of Kern river in April, 1880.

No. 3. Water from irrigation ditch of the Kern Valley Irrigation Company, taken at a point 2 miles below Bakersfield. Both the above samples were furnished by the superintendent of that company. The water at that time was just beginning to receive the melting snows, and was slightly turbid, and of course somewhat diluted, as compared to its condition in winter.

Nos. 4 to 10 have been described as above.

No. 11. Water taken from King's river at Kingsburg, June 19, 1880, by Mr. J. D. Schuyler, of the state engineer corps.

No. 12. Water taken from King's river at Kingsburg, in November, 1880, before any rains had fallen.

No. 13. Water taken from the San Joaquin river at the crossing of the Southern Pacific railroad, in November, 1880, after the first rains; perfectly clear.

No. 14. Water taken from the Merced river at Snelling, Merced county, in December, 1880, after the first rains had raised the river slightly above the lowest water-mark. It was slightly turbid with clay, which filtration could not remove, but was eliminated after evaporation.

No. 15. Water taken from the Mokelumne river at Woodbridge, San Joaquin county, in November, 1880, after the first rain, which had slightly raised the river. Water slightly opalescent from suspended clay, and residue corrected for same, as in No. 14.

No. 16. Water of the Sacramento river, taken from a hydrant in the city of Sacramento, September 19, 1878. The data have been recalculated from the published results, so as to conform to the mode of presentation here adopted, which explains the apparent discrepancy of the tables as here given.

No. 17. Water from a well at Point of Timber, Contra Costa county, furnished by Mr. T. W. A. Carter, of that place. This water is found abundantly about 8 feet below the surface in that region, and, if available for irrigation, could be obtained in unlimited quantities by pumping, but the inhabitants stated that it "would kill the soil".

Analyses of waters from the San Joaquin valley.

[Grains per gallon.]

	Total residue.	Carbonate of soda.	Common and Glauber's salts, etc.	Carbonates of lime and magnesia and silica.	Vegetable matter.
1. Los Angeles river	14.30	.....	8.46	5.84	.....
2. Kern river (cañon)	9.49	1.22	1.77	5.55	0.95
3. Kern river (ditch)	9.62	1.23	2.21	5.33	0.85
4. Kern lake	211.50	64.37	115.41	9.29	22.43
5. Tulare lake (south end)	84.44	27.92	37.85	13.44	2.28
6. Tulare lake (middle surface)	81.95	35.30	35.96	5.37	5.32
7. Tulare lake (middle, 10 feet below surface)	70.36	30.46	28.10	7.39	4.41
8. Tulare lake (middle, 20 feet below surface)	81.72	.....	.....	.....	.....
9. Tulare lake (near mouth of King's river)	38.55	13.46	15.01	5.11	4.97
10. Tulare lake (near outlet of west side canal, 10 feet below surface)	76.00	30.95	33.95	6.60	4.50
11. King's river (June)	4.13	.....	0.86	3.27	.....
12. King's river (November)	5.03	.....	.....	.....	0.19
13. San Joaquin river	4.54	0.45	0.15	2.15	0.69
14. Merced river	5.64	0.19	0.09	4.18	.....
15. Mokelumne river	6.97	.....	0.42	4.42	3.70
16. Sacramento river	6.69	0.27	4.02	2.41	.....
17. Point of Timber (San Joaquin delta), well water	67.75	10.83	48.41	7.41	1.10

The following table shows more in detail the composition of three of the waters given on page 71 in a general manner:

Ingredients.	Los Angeles, city hydrant, river water.	Tulare lake, middle, ten feet below surface.	Sacramento river, city hydrant.
	Grains per gal.	*Grains per gal.*	*Grains per gal.*
Carbonate of soda	.....	30.46	0.27
Chloride of sodium (common salt)	1.00	20.27	1.42
Sulphate of sodium (Glauber's salts)	4.14	7.54	
Carbonate of lime	0.38	2.49	0.31
Carbonate of magnesia	4.29	4.21	0.25
Silica	1.17	0.69	1.85
Sulphate of lime	0.78	.....	0.42
Phosphate of lime	2.18	.....	1.48
Iron and manganese carbonates	0.26	.....	0.63
Alumina	0.16	0.29	0.07
Vegetable matter	.....	4.41	.....
Total residue	14.30	70.36	6.70

In discussing the quality of these waters in reference to irrigation it must be understood that the group of ingredients mentioned in the fourth column of the first of the above tables, viz, carbonates of lime and magnesia and silica, are not only useful to vegetation, or unobjectionable, but are also very soon deposited and retained in the soil. We therefore leave them out of consideration so far as the alkali question is concerned. For this the carbonate of soda and the salts mentioned in the third column are of chief importance, and among these the corrosive carbonate of soda is the most noxious by far. The prominent facts shown in the above table may be thus stated: The water of the Los Angeles river, though containing a large aggregate amount of solid ingredients, has none of the carbonate of soda, but only neutral and earthy salts, of which a very large amount only is injurious. This fact, together with the perviousness and free drainage of the lands irrigated, explains why it is that even those which have been longest under cultivation and irrigation in that region do not show any serious increase of alkali, and may never do so if abundance of water is used, at least from time to time. But as irrigation water becomes more closely utilized and relatively more scarce the leaching process will occur less frequently, and the accumulation of alkali salts near the surface will become more and more apparent.

In the water of Kern river the proportion between the carbonate of soda and the other salts is almost the same as in the water of Tulare lake, in the proportion of about 1 to 22. In other words, if 22 gallons of Kern river water were boiled down to 1 gallon, the alkali in this water would, in quantity and quality, be the same as in the water of Tulare lake; and if this gallon was still further reduced to about three pints and a half, the remaining water would have about the composition of the water of Kern lake, as it was in March, 1880. Comparing the water of King's river with that of Kern river, we find that in the latter the aggregate amount of solid residue in the water is less than half that found in Kern river. This, however, is to some extent due to the season at which the water was taken, it being then diluted with snow water. For purposes of comparison we should take the figure obtained for the residue in November, when the solid contents were at their highest amount. But even on this basis we find that the amount of carbonate of soda in the King's river water is utterly insignificant, being not yet one-hundredth of a grain per gallon, against about one and a quarter grains per gallon of Kern river water, while on the same assumption the percentage of other soluble salts is about twice as great in the latter.

Of the other rivers of the valley the San Joaquin shows the highest amount of carbonate of soda, but yet only about one-third as much as Kern river. The Merced has less than one-sixth as much of the same, the Sacramento less than one-fourth. Between the latter two we find the Mokelumne with none at all, there being some chlorides of magnesium or calcium in solution to the extent of about one-tenth of a grain per gallon—an insignificant amount. The water of the Los Angeles river likewise is free from carbonate of soda; but its aggregate of soluble salts is somewhat high, exceeding in this respect even Kern river by 1¼ grains. It is credited with a very large proportion of phosphates, as is also the Sacramento river. In the other analyses made these were not determined for want of material.

It appears from these comparisons that of the streams examined the Mokelumne has naturally the best water from the irrigator's point of view. King's river comes next, with a water whose purity is the more remarkable, as its sources lie so near those of the Kern. The Merced comes next, having somewhat less of the objectionable carbonate of soda than the Sacramento; but if corrected with gypsum its waters would be placed at head of the list as the purest of all. The San Joaquin river has the smallest total of solid content of all the waters taken at the same season, but contains over twice as much carbonate of soda as the Merced; if corrected with gypsum, its water would contain less than half as much of soluble salts as that of the Sacramento, one-half less than King's river, and only one-fifth as much as that of Kern river.

It will thus be seen that the correction of the irrigation waters of the valley by means of gypsum would in all cases but that of the Mokelumne effect a very important improvement as regards the safety of their continued use on soils of which but too many have already the full dose of alkali compatible with profitable cultivation. The change could doubtless be easily accomplished by interposing, at suitable points in the ditches, sluice-boxes filled with coarse fragments of gypsum, renewed from time to time as the action of the water converts the gypsum into carbonate, or common limestone; or the gypsum may be applied to the soil itself, and thus be made to neutralize not only the soda of the irrigation waters, but also that in the soil itself, at the same time introducing a useful fertilizer. The amounts to be thus used may effectively vary, according to circumstances, from 200 to as much as 1,000 pounds for the first application, smaller doses to be used thereafter at such intervals as experience may dictate. Precautionary measures of this character should be employed as soon as possible by the inhabitants of the fertile valley of Kern river. Those using its waters should keep in mind that their evaporation adds annually to the alkali already in the soil a small but not inappreciable amount, which in some cases may, after a few years, prove "the straw that breaks the camel's back"; and that therefore some of the means mentioned as remedies against this kind of alkali especially should be currently employed to keep it in abeyance. Tillage after irrigation, the planting of deep-rooted crops instead of grain, and the use of gypsum as a neutralizer of the worst ingredient, the carbonate of soda, are the measures that suggest themselves as the most feasible; while sub-irrigation, and especially the leaching out of the alkali from time to time by long-continued flooding and underdrainage, are more radical remedies for future use.

The water from Point of Timber offers some interesting points, suggestive of a state of things that may have to be taken into consideration in all plans for the irrigation of the west side of the San Joaquin valley. From its location, this water might have been

conjectured to derive its ingredients from tide-water percolating into the loose strata. So far from this, its composition is closely analogous to that of the water of Tulare lake, except that the proportion of carbonate of soda is considerably less, and therefore it is not likely to be as injurious in its effects on vegetation. Yet the inhabitants report here also that to irrigate with it "kills the soil", *i. e.*, renders it unproductive. It will doubtless do so when applied in small quantities only, and repeatedly; but it is likely that if used as suggested in the case of the Tulare water (that is, so as to leach the alkali out of the soil once in a season into the underlying water-table) it might be successfully employed for irrigation, especially if, at the same time, the carbonate of soda were neutralized by the use of gypsum. If it be thought too fanciful to suppose, as has been done, that the alkali-water stratum at Point of Timber represents the seaward seepage of Tulare lake itself, it is nevertheless quite probable that it does represent the quality of the underground drainage of the west side of the San Joaquin valley, and is connected with the persistent appearance of "alkali spots" at every low place in the valley, from Antioch up to Kern lake.

With the lights now before us, it can hardly be regretted that the old Westside ditch, which was to irrigate the lower country with the corrosive waters of Tulare lake, was not successful. The lake level is now several feet below the bottom of that outlet, and the lake keeps receding annually, and its alkali becomes stronger as the mass of the water decreases. It is difficult to say where it will stop; but if, as is probable, a state of equilibrium is reached whenever the waters of Kern and King's rivers shall have fully filled the parched depths of the plains by a more general system of irrigation, it is not at all probable that the lake water will thereby become fresher; on the contrary, such seepage water will be likely to bring into it the alkali now dried up in the lower strata, and the annual evaporation will concentrate the solution more and more. It would certainly be most desirable to utilize the lake as a great reservoir for irrigation supply; but to render this practicable it would be necessary first to empty out or displace the mass of alkaline water at present occupying the basin. The discussion of the feasibility of such an undertaking, however, belongs to the province of the engineer corps.

From the facts above given regarding the alkali soils and irrigation waters of California the importance of investigating thoroughly not only the quantity but also the quality of the waters available for irrigation in the arid regions is sufficiently obvious. The facts as nature has made them should be elicited and plainly set before the people, so that money may not be invested in useless undertakings, or damage done which it may be difficult to undo thereafter. There are, probably, but few river waters in the world of such composition or natural purity that continued irrigation without correlative underdrainage can be practiced without in the end causing an injurious accumulation of soluble salts in the soil. In India, according to the testimony of Professor George Davidson, the evil effects of such practice have become painfully apparent, and to such an extent that after the expenditure of enormous sums for bringing the water upon the fields the government now finds itself face to face with the costly problem of its economical removal, by drainage, so as to relieve the soil of the accumulated "alkali", which has rendered it unfit for cultivation. An early attention to this matter, with such foresight as will prevent the occurrence of similar difficulties, cannot be too earnestly recommended to all interested in lands needing irrigation from the Pacific coast to Colorado and Kansas.

COTTON CULTURE IN CALIFORNIA.

HISTORY.—It is stated, and is in itself extremely probable, that the missionary padres introduced the cotton-plant from Mexico along with other culture plants; but no definite data on the subject are extant. As a textile fiber for home use the wool of sheep was mainly resorted to, the methods of production being better adapted to the indolent habits of the domesticated Indians, as well as to those of their Mexican successors.

Cotton culture began to attract considerable attention in California in 1856, at which time a premium of $75 was offered by the State Agricultural Society for the best acre of cotton. How long previous to that time its culture was engaged in to any extent is not known, but it was doubtless made the subject of experiment in very small tracts for a year or two. At the annual meeting of the society in that year no award seems to have been made, and the visiting committee reported that in their visits to different parts of the state they had seen a patch of cotton of extra quality at Monte, Los Angeles county, containing less than an acre; they thus leave the inference that no other growing cotton was seen by them. The president of the society, in his address at the same meeting, casually spoke of cotton culture as a successful experiment.

In the next year, 1857, the following report was made to the society by its committee of awards on sugar-cane, tobacco, and cotton:

> The committee also examined the several specimens of cotton, and, as with the cane, we have to report the successful growth of this great staple. We also examined in contrast Georgia upland cotton, and the growth in this state from seed taken from the same parcel, and the improvement in fineness of fiber of the native growth over the imported or Georgia grown was manifest and striking; and in this we have the concurrence of experienced spinners from the east. But the staple of the native is not quite so long, though fully as strong as the Georgia cotton. This we attribute altogether to the lack of moisture in the earth where it grew.
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> * * * * * * *
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> Several other samples examined rate as fair upland. The one from Slocum's Bridge has the advantage of staple and texture over any of the others. The samples grown in Los Angeles county are equal, if not superior, to the best Mississippi or Louisiana cotton, and of course superior to all others, and one grade below sea-island cotton. This sample is not of the sea-island seed, but of the gray Petit Gulf kind, proving conclusively the perfect adaptation of our climate and soil to the production of the very finest staple.

This last sample was grown on a loose soil, and was probably some of that seen growing the year previous by the committee. Samples of cotton grown in Shasta county this year were on exhibition also in San Francisco.

In the following years, although premiums were offered by the society, no awards seem to have been made, and only slight mention is made of cotton until 1862 (except in Kern and Sacramento counties in 1859), when the legislature, under the initiative of Mr. Robert Strong, of Merced, offered the following premiums: For the first 100 bales of cotton of 300 pounds each, $3,000; for the same quantity produced in the first, second, and third succeeding years, $2,000, $1,000, and $500, respectively. Other premiums were offered for cotton cloth.

At the next meeting of the legislature a supplemental act provided that one-half or one-quarter of these premiums should be paid to any person producing one-half or one-quarter of any of the quantities named in the original act. No awards seem to have been made, or even applied for, until 1865, when Mr. Mathew Keller, of Los Angeles, planted and raised 108 acres of cotton and received on the 22d of December the state premium of $3,000. In the same year there were a number of other cotton farms in the southern part of the state, one of 130 acres on Kern lake, in Kern county. The acreage for this and Los Angeles county was estimated at 450 acres, the average yield being one-third of a bale per acre. In Fresno county a farm of 100 acres was reported on Upper King's river, in Merced county, at Snelling; another of 100 acres on Upper King's river, in Fresno county.

In 1866 the report of the agricultural society reviews the subject of cotton culture as follows:

The history of the cultivation of cotton has also been an anomalous one in this state. Experiments on a small scale had been made for a number of years in different sections with gratifying success. Encouraged in part by these results, and in part by the very liberal bounty offered by the state for the first production in large quantities, several parties in the southern counties planted quite extensively in 1864. They all labored under adverse circumstances. Their seed was in great proportion of those varieties not adapted to our climate, being of the large, late varieties and of a poor quality, rendering replanting to a great extent necessary. As the parties referred to were competitors for the state bounty on a hundred acres, they strained every nerve, but more to secure the number of acres specified to be planted than to insure a proper cultivation of the crop after it was planted. But, notwithstanding all these unfavorable circumstances, they all produced a more or less creditable crop, those portions of their fields which were planted with the Tennessee upland and Petit Gulf seed making excellent crops both in respect to quantity and quality. One of the parties alluded to, in a letter to the secretary of this board, says: "The sum of our experience may be considered to be: First. That the Petit Gulf and the Tennessee may be considered the safest and most profitable, and should be planted as early as frost will allow. Second. That the low bottom and tule lands of the state are well adapted to the raising of cotton. Third. That from the hardy nature of the plants but little skill is required in irrigation, and that much less water is required than would be necessary in the successful cultivation of corn. Fourth. That the seasons in California are especially favorable to the production and the harvesting of cotton."

In this year cotton was raised at Folsom, Sacramento county. In 1867–'68 one-half acre was planted in Lake county, which yielded 50 pounds of lint, while in southern counties there were a number of cotton farms. In 1871 Colonel J. M. Strong, who had been experimenting on cotton culture since 1864, planted 100 acres of cotton on the Merced river lands. The seed was carefully selected, and, though planted on the 20th of June and cultivated only once, the yield was about 750 pounds of lint per acre. Previous crops on a smaller area and with indifferent seed had given him with one cultivation a yield of 500 pounds of lint per acre.

In this year cotton was produced also on the red-clay lands near Sacramento, on Butte slough, in Sutter county, and on the tule marshes at Knight's landing, Yolo county. At the latter place the sea-island variety was planted; it grew to a height of 5½ feet, but did not mature. On Cache creek bottom, in the same county, cotton grew 4 feet high, some of the stalks having each 200 bolls.

An experiment was also made at Colonia, in Santa Barbara county, but the cotton was planted on June 5, and did not mature well.

In 1872 the largest acreage of cotton was in Merced county, nearly 700 acres being planted in the vicinities of Snelling, Hopeton, and Mariposa creek, and two farms of more than 200 acres each were reported; 140 acres were planted near Bakersfield, Kern county, and smaller tracts in other southern counties. Cotton-gins were erected in Merced and Kern counties.

In 1873 the cotton acreage in Merced county alone was estimated to be from 1,500 to 2,000 acres. On the 11th of May of this year the first export of cotton was made from California, the Buckley Brothers, of Merced county, shipping 22,886 pounds by the ship Ontario to Liverpool. Among this was a small lot of Nankin cotton, which received high commendation at Manchester. The seed of this, however, has since been lost. The culture of cotton has been steadily continued on the Merced bottom farms ever since, with an acreage ranging from 350 to 500 acres.

The largest experiment in cotton planting reported from the Sacramento valley between 1872 and 1881 was that of Mr. J. L. Jackson on bottom land of the Sacramento river, in 1876. He planted 180 acres, and obtained a stand on 160 acres. Cultivation was somewhat neglected, and the cotton was not all picked, most of it only once. The product was 30,000 pounds of lint, or about 188 pounds per acre. The staple, of which samples were seen by me, was excellent. A number of smaller plantings were made in the same region about this time, but the want of a home market discouraged a continuation of the culture.

The personal observations made on the occasion of my visit to the Merced cotton farms in 1879 are given below in connection with the cultural details. The total acreage at that time was 375.

The following year (1880) a field of about 60 acres was planted at Belleview ranch of Haggin & Carr, in Kern county. This experiment was of especial importance, because covering a tract of land which, under continued surface irrigation, had become so strongly impregnated with alkali that it failed to grow wheat any more, and also because of a careful record kept of the cost and returns, which is given on page 76, from an article in the *Pacific Rural Press*. The financial exhibit there given is not very flattering, as might be expected the first year of trial; but it is a great deal better than could have been obtained on the same field with wheat. In any case, the outcome has been sufficiently satisfactory to induce the planting of a considerably greater breadth.

In the Mussel Slough region of Tulare county also some excellent samples of cotton were grown in 1881, and as the "alkali question" becomes more pressing and interferes with the success of wheat culture it is likely that cotton will become a favorite crop.

Experiments made with sea-island and upland cotton on 500 acres near Williams, Colusa county, and near Gridley, Butte county, seem to prove that cotton will yield good results in the Sacramento valley without either irrigation or the frequent rains considered so necessary to the welfare of the cotton-plant in the southwestern states. The sea-island variety, however, on both fields was a complete failure.

METHOD OF CULTURE.—The following method, given by Mr. J. W. A. Wright (*a*), speaking of the cotton culture in the San Joaquin valley, is usually practiced by those most prominently engaged in cotton culture:

To prepare the land some begin plowing in December and others not until February. As a general rule, the earlier the better. Some plow only 4 inches, while others plow as deep as from 10 to 12 inches. Planting is not done in ridges, as in the southern states, but (because of the drier climate of California) in furrows run about 4 feet apart. The time of planting varies from the last of March to the 10th of May, though successful crops have been raised when planted as late as the middle of June. "It has been found best to soak the seed in a pool of cold water, at least from twelve o'clock noon until early the next morning, and then to mix with ashes; this kills the eggs of the insects which often destroy the crop." The seed comes up in from five to fifteen days, according to the time of planting and to the depth to which covered. It should be covered about 2 inches. The plants, when up, are thinned out with a hoe, leaving one or two at distances of from 18 to 24 inches apart. The after-cultivation is less than that given in the southern states, especially on the uplands, where weeds are not very troublesome. Some planters plow three times and hoe once, others on bottom lands plow twice and hoe twice, at intervals of from twenty-five to forty days, beginning two weeks after the plant is up. By some the southern method is practiced of running the plow at the first plowing near the roots of the plant and throwing the soil from the plant, and at the second plowing throwing it back. The blooms begin to open toward the end of June, and the bolls begin to open in September. The plant attains a height of from 3 to 7 feet, with an average of 4 feet, and from 300 to 400 good bolls have been counted to the plant, averaging usually 100. Three pickings are sometimes given to the crop, the first in the last of September, the second in October, and the last toward the close of November. Some planters continue the picking into January or February.

In regard to irrigation, speaking of the San Joaquin valley, Mr. Wright says:

> The facts deduced from the experiments on cotton do not make it safe to establish definite rules for the time, amount, and frequency of irrigation. These matters are to be regulated by the moisture of the ground and the character of the seasons. As regards the method, some conduct the water in furrows, made with a 10-inch turning plow, within a few inches of the rows of plants; others flood the land after the cotton is up. Water has covered the plants twenty-four hours without apparent injury. When the crop has been flooded, it is indispensable to plow the land as soon as it is dry enough to bear a plow and team, say within a week after irrigation. The usual interval between irrigation is from thirty to forty days; the number of times usually three, beginning in May and ending in August. The natural moisture of the ground then begins rising toward the surface on our plains, and irrigation after that date is not essential. The most important point to guard against in irrigating cotton is not to allow the growth to be checked by want of moisture after the young bolls or squares begin forming and then renew the growth of the plant by irrigation. So surely as this is done, the squares already formed will drop off and the yield be diminished to that extent.

On a visit to the cotton farms of the Merced valley the following details were ascertained: The cotton acreage was (1879) 225 acres on the Strong farm and 150 acres on the farm of W. A. Grade, near Hopeton. On the former place the aspect of the plant was very uneven, those portions of the field having a shallow soil, underlaid by gravel, being hurt by drought, and it being almost too late for irrigation. On Grade's land the stand was more regular, the soil being more uniformly deep, the height of the plant being from 3 to 4 feet and fairly bolled, yielding that season 1,000 pounds of seed-cotton per acre; in good seasons easily averaging 1,200 pounds, making 300 pounds of lint, formerly 500 pounds.

The planting is done in March or the first week of April, there being little danger from late frosts here. Cultivation is level, the rows about 4 feet apart, and the plants from 18 to 24 inches in the row. The land is kept very clean, and is plowed or cultivated as often as may be rendered necessary by the season. One irrigation is given in June, just before the time the blooms begin to open; then no more, as it does not seem to be required, and trouble from weeds is avoided. The plants, originally from Mississippi (Petit Gulf) seed, have a curious habit of forming long branches from the base of the stalk, thus spreading more than is usually seen in the cotton states. Along these branches the bolls are strung thickly, sometimes apparently of the same age for 18 inches or 2 feet, and, especially in the low and somewhat over-irrigated grounds, are inclined to be slow in opening. Near the river such long, heavily bolled branches are having a new growth and are blooming abundantly, while not a boll seems as yet (October 14) inclined to open. On the higher ground the plants have mostly ceased blooming and the bolls are opening well, though somewhat slowly. This sluggishness in opening seems to occur to a greater or less degree all over the San Joaquin valley. Light frosts accelerate it materially. There is not usually any killing frost here; hence picking can be done very clean.

Picking is chiefly done by Chinese, who in that year were paid 90 cents per 100 pounds of seed-cotton. The best hands pick 180 pounds a day, the majority between 75 and 90 pounds. They carry a large sack slung over their shoulders, thus lugging along from plant to plant from 50 to 75 pounds at times; they use no baskets. It is very slow and awkward work compared to that done by the southern negroes.

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a Lecture delivered at the University of California October 15, 1875.

Cottonseed has thus far been used for feed only, being sold to sheep-raisers at $4 per ton. The decrease in the average product of the land shows the loss from this mode of disposing of the seed, and it is strongly advised that it be regularly returned to the soil. A "Magnolia" 40-saw gin was being used in ginning. The staple is fine, long, and strong, as is shown by the measurements given in the preliminary part of this report, volume I.

Besides the large-scale experiments in the southern region above recorded, small patches of cotton have been grown there by small farmers and by the Mexican population for many years for home use. Since in that climate not uncommonly several years elapse without a "killing" frost, the plant is perennial, and bears several crops, the staple, however, becoming apparently shorter and more harsh as the plant becomes older. A sample of fiber from a three-year-old plant at San Diego is reported upon in the record of measurements made by Professor Ordway. It may be questioned whether in some cases the plantations might not be profitably continued through the second year at least, even with a somewhat inferior fiber, of which, however, on account of the long season, the yield would be very high. Further experiments on this subject are needed.

COST OF PRODUCTION.—The following estimate was made by Colonel J. M. Strong, of Merced county (who had been a planter for several years), on the basis of 200 acres in 1872:

Twelve hands, $25 per month	$3,600 00
Feed of team	500 00
Feed of hands	1,500 00
Extra gathering	500 00
Ginning and baling	500 00
Blacksmithing	100 00
Total expenses for 200 acres	6,700 00
Total expenses for 1 acre	33 50

The yield was 150 bales, making the average cost $44 66 per bale, or about 9 cents per pound of lint. This, with an average of from $6 to $8 per acre for planting and cultivation (against $33 50 above), would make the total cost of production about 4½ or 5 cents per pound of lint when the yield is 500 pounds of lint per acre.

The following estimate is that of Mr. J. B. Haggin as the result of the cultivation of 59.12 acres of cotton in Kern county in 1880:

Plowing	$104 50
Irrigating	120 50
Hoeing	295 50
Picking	578 00
Ginning and baling	99 61
Rope and twine	32 78
Burlap	23 05
Seed	33 48
Total	1,287 42

In addition to the above the following expenses are considered:

Hauling to depot	12 37
Railroad freight	108 14
Storage	10 70
Commissions	24 88
Total cost	1,443 51
Sales at from 12 to 14 cents per pound	1,990 05
Balance above cost	546 54
Cost per pound to make and bale at ranch	0 08
Cost per acre to make and bale	21 77
Cost per pound to make, bale, and deliver in San Francisco	0 09
Net profit per acre	9 24

The yield and quality of cotton was good. A sample was sent to New Orleans, and valued there at 12½ cents. This was the first year of cultivation, and many difficulties were encountered: first, the seed was old; second, there was a difficulty in having the cotton picked—white men will not pick, and not many Chinamen were found that could; third, the use of the gin for the first time.

CONCLUSIONS.—From the record above given it appears that cotton has been successfully grown at many points, practically covering the whole of the great valley, a part of the foot-hill lands of Shasta and a part of Napa county, and to the southward all the agricultural portion of the southern region. By inference drawn from similarity of climate and products, without direct test, we may include within the possibly cotton-growing portions of the state the valleys of Napa and Sonoma, the agricultural portion of Lake county, the foot-hill region of Tehama, and the entire "lower foot-hills" of the Sierra. On the other hand, all the Bay region, as well as the seaward valleys of the entire Coast range, are excluded from the cotton-growing area by reason of the cool summers, trade-winds, and fogs to which they are subject.

In addition, it may be broadly stated that in the Sacramento valley cotton may on deep soils be grown without irrigation, while in the San Joaquin valley it, like all other crops, must be irrigated to insure profitable returns. The best experience seems, moreover, to indicate that, as in the case of the vine, the minimum irrigation that will enable the plant to develop is that which on the whole gives the best results, inasmuch as late irrigation especially tends to retard the opening of the bolls and in the low portions of the fields to start new growth, leaving the older bolls stationary.

The sea-island variety is a failure thus far wherever tried. That cotton culture has not assumed larger proportions in California as yet is adequately explained by the fact that the home market is, in the absence of cotton factories, extremely limited, and the long distance from the world's markets renders competition with the Atlantic cotton states on the one hand and with India on the other a doubtful matter, which could be turned in favor of California only by exceptional circumstances, such as peculiar excellence of the staple. At the same time, cotton production has been found profitable so far as the home demand has gone, and good prices have been obtained; and when exported the California staple has rated high in comparison with the average product of the Gulf states.

What, then, are the inducements toward an expansion of cotton culture in California, and the possible establishment of cotton factories on the coast to create a home demand?

With the equalization of the prices of labor, in consequence of increased facilities of communication, there certainly is no reason why the home demand for cotton goods on the Pacific coast should not be supplied from home growth and manufacture, and there is reason why it might secure a large share of the Asiatic market, with which it is in the most direct connection.

But, it may be asked, why try to substitute a new and doubtful culture for the wheat, fruits, and wines for which California has already become famous, and of some of which it has practically a monopoly in the United States?

Apart from the general rule that the greater the variety of crops and industries of a country the more independent and the less liable it is to crop failures of a general character, there are two points that speak strongly in favor of at least the partial substitution of cotton for wheat. One is the well-known fact that wheat culture is very exhaustive of the soil, notably of the phosphates, especially when the grain is chiefly used for export, little or nothing being given back to the soil, and the same crop being repeated year after year in a wholesale fashion. It is hardly necessary to expatiate upon the fact that this kind of farming, or rather planting, is doomed to speedy termination, and that while for the time being it enriches individuals it is of very doubtful permanent benefit to the country. The exhausted wheat-fields must wait for the coming generation of more careful farmers—true husbandmen, not skinners of the soil—to be rehabilitated into something like their original productive value. That has been the history of wheat-growing all over the Atlantic states, and is certain to be repeated in California. When the wheat-fields cease to be so profitably productive as to be able to compete with the fresh lands of Washington, Montana, Dakota, and Minnesota, what crop shall be substituted for that grain? It is idle to say that there is plenty of time yet before the question arises. The truth is, that in the older settled portions of the state it is already upon us, for the average product per acre is rapidly falling from the surprising figures of old—40 and 50 bushels per acre—to the modest 12 or 15 bushels of eastern states, and it is impossible that it should be otherwise; but the man who grows 15 bushels per acre cannot long compete with those still able to grow double that amount. A portion of the lands so thrown out from wheat culture may be given to orchards and vineyards; but it will be long before these industries can occupy all the ground, if indeed the state of the world's markets would permit of their indefinite expansion. Alfalfa, which it has been proposed to substitute for grain, cannot find sufficient consumption at home, and is too bulky for export. Many other crops might be suggested that will doubtless hereafter find a profitable place in the agriculture of California, but among these there is every reason to believe that cotton will occupy a prominent place, especially since it can be grown on any naturally fairly productive soil for scores of years without thought of other manure than its own seed regularly returned to the soil. It is in this respect the reverse of the exhaustive wheat crop; for a crop of cotton lint takes no more from the soil than the chaff of the wheat would were it a merchantable article, while the grain and straw were returned to the soil.

This point is treated more exhaustively in the article on the uses of cottonseed, included in the preliminary part of this report, volume I. It is true that cotton is one of the most exhaustive crops when the seed is definitely removed, as has unfortunately been the prevailing practice in the cotton states; but it is equally true that no other crop now known is so little exhaustive as cotton when the seed and stalks are returned. This is more especially important, in view of the fact, apparent from the analyses heretofore given, that while as a whole the soils of the state are unusually rich in potash, their average content of phosphoric acid is far from large. Their abundant yields are due to their large supply of lime, through the agency of which the plant-food contained in them is made quickly available. But while it is true that calcareous soils are particularly thrifty, it is also true, and well known, that when they do become exhausted they require the most generous manuring to become productive again.

There is another reason in favor of the planting of cotton as against the planting of wheat (at least as the latter is now practiced) when irrigation is required. This is the fact (too well known to the population concerned, and more specially treated of in the article on alkali soils on pages 63 to 73) that on lands afflicted with alkali the evil

is steadily on the increase, on account of the "rise of the alkali", as a consequence of continued surface irrigation. The last flooding of the wheat leaves the soil with a dense crust, from which the soil-water evaporates rapidly, and which, the grain being sown broadcast, cannot be broken and the surface soil put in the condition of tilth necessary to prevent the accumulation of the alkali salts at the surface. More and more every year the "dead spots" in the wheat-fields increase, and when, on account of such failures, it ceases to be profitable, something else must be substituted, and that substitute must be a hoed crop, planted in drills, and capable of being cultivated at all times. It should, moreover, be a deep and tap-rooted crop, requiring the least amount of irrigation, on account of the depth to which its roots reach. Cotton fulfills pre-eminently both conditions. It needs and responds generously to clean and frequent tillage, and in this it would tend to fill the period of comparative idleness experienced by the California grain-grower between harvest and seeding time that for the time, being throws a large number of laboring men out of employment. By the proverbial spreading out of the work over the entire twelve months cotton serves to secure steady employment, and therefore a steady laboring class.

In one respect, too, the California cotton-grower has a great advantage over his southern competitor. The latter has to "fight the grass" throughout the season; in fact, to keep the cotton "out of the grass" is his never-ending task. In the Sacramento valley, where cotton can be grown without irrigation, weeds cease to worry the farmer after the dry season sets in if the ground has been properly attended to before. No summer showers start a new crop of grass and compact the surface into a strangling and moisture-wasting crust. If clean to the dry season, the ground remains clean, save perhaps a few large straggling weeds that can be done away with by a few strokes of the hoe in each row. There is no crab-grass to go to seed every autumn, as an earnest of the perennial renewal of the grass fight.

Finally, where irrigation is once established, it will secure a cotton crop without fail every year, instead of the often-recurring summer droughts that so frequently stunt the crop in the Mississippi valley, and the waters of the fortnightly shower, thought there to be desirable for the best success of cotton, could here be made a certainty. But, singularly enough, such treatment is found not to benefit the plant in the climate of California, so that, in comparison with some other crops, cotton culture would be economical as regards irrigation water.

Keeping all these points in view, the writer cannot but think that the wider introduction of cotton culture into California is but a question of time, and that in many respects it will serve to improve the agricultural prosperity of the state.

Chemical analyses of California soils and subsoils.

Number.	Soil title.	Locality.	County.	Depth.	Vegetation.	Insoluble residue.	Silica, soluble in Na_2CO_3.	Total insoluble residue and silica.	Potash.	Soda.	Lime.	Magnesia.	Brown oxide of manganese.	Ferric oxide.	Alumina.	Phosphoric acid.	Sulphuric acid.	Carbonic acid.	Water and organic matter.	Total.	Hygroscopic moisture.	Temperature of absorption C.°	Analyst.
	SACRAMENTO VALLEY REGION.			*Inches.*																			
563	Sacramento river alluvium.	Rancho Chico	Butte	12	White oak (*Q. lobata*), ash, sycamore, and grape-vines.	70.764	2.680	73.444	0.652	0.077	1.444	2.277	0.015	5.804	10.397	0.087	0.030	.....	5.351	99.578	6.84	11.5	Jaffa.
561	Black loam soil	do	do	12	Sunflowers and alfilerilla.	59.144	3.160	62.304	0.305	0.221	2.909	1.042	0.025	9.342	13.088	0.095	0.068	.....	10.149	99.498	13.98	13.0	Do.
517	Brownish loam soil	Biggs' Station	do	.....	Oaks	63.268	4.750	68.018	0.453	0.113	1.460	2.174	0.105	8.585	12.045	0.064	0.047	.....	6.701	99.765	8.29	13.0	Do.
656	"Slickens" sediment	Yuba river	Yuba	.....	Cottonwood and willow.	72.169	3.071	75.240	0.267	0.025	0.794	0.866	0.025	6.582	10.390	0.070	0.134	.....	5.716	100.115	.....	.....	Do.
1004	do	Alger's Bend, Feather river.	Butte	.....	do	61.029	8.033	69.062	0.300	0.124	0.521	0.768	0.089	6.586	14.229	0.078	0.067	.....	8.024	99.848	16.09	15.0	Do.
10	Sediment soil	Sacramento river	Sacramento	12	.....	55.283	13.940	69.223	0.353	0.065	0.901	1.249	0.111	6.316	15.251	0.250	0.097	.....	6.751	100.567	.....	.....	Sutton.
110	Putah valley soil (middle land). (a)	Dixon	Solano	12	Cultivated	67.334	3.671	71.005	0.929	0.124	0.770	2.285	0.106	8.011	9.159	0.111	0.120	.....	7.115	99.735	10.32	15.0	Jaffa.
	SAN JOAQUIN REGION.																						
	Alluvial or loveland soils.																						
6	Black adobe soil	S. 45, Weber grant, near Stockton.	San Joaquin	12	Scattering oaks	.....	.....	72.058	0.396	0.479	1.927	1.640	0.056	6.815	11.620	0.179	0.087	.....	5.871	101.078	.....	.....	Sutton.
7	Hard-pan subsoil of No. 6.	do	do	.....	.....	.....	.....	64.903	0.248	0.404	8.502	2.700	0.034	5.672	6.252	0.324	0.056	6.229	4.860	100.184	.....	.....	Do.
195	Valley soil	Merced ditch	Merced	.....	Grass, herbs	75.405	8.286	83.691	0.423	0.125	0.758	0.621	0.038	4.452	6.331	0.048	0.046	.....	3.882	100.415	5.48	14.5	Jaffa.
198	Merced river bottom soil(a)	Hopeton	do	.....	Sunflowers; some oaks and cottonwood.	73.120	3.882	77.002	0.509	0.094	1.316	0.547	0.036	9.078	5.090	0.132	0.094	.....	5.991	99.949	5.67	.....	Do.
701	Dry bog soil (a)	Sisson's ranch	Tulare	.....	Mostly grasses	67.519	4.259	71.778	0.562	0.657	2.599	0.753	0.066	5.599	12.395	0.074	0.145	0.083	4.495	99.306	11.19	15.0	Do.
585	"Wire-grass" soil (a)	Visalia	do	.....	White oak, wire, and alkali grass; alfilerilla.	66.470	4.950	71.420	1.224	0.677	3.043	0.067	0.030	5.823	7.137	0.239	0.655	2.546	7.091	99.972	8.53	15.0	Do.
570	Brown adobe soil (a)	Eisen vineyard	Fresno	.....	.....	76.622	2.870	79.492	0.714	0.444	1.769	2.048	0.041	3.728	7.988	0.038	0.074	.....	3.244	99.580	5.43	.....	Do.
579	Alluvial loam soil (a)	Grangeville, Mussel slough.	Tulare	12	Wild flowers; grass	79.518	3.219	82.737	0.700	0.286	1.246	1.578	0.018	4.030	6.578	0.069	0.019	.....	3.049	100.310	3.89	15.0	Do.
77	"Dry bog" soil	Tulare lake	do	12	Salt-grass	.....	.....	67.340	1.050	0.840	6.510	3.960	0.040	5.050	7.970	0.320	0.080	4.420	3.710	101.290	.....	15.0	Morse.
	Uplands or bench soils.																						
193	Loam soil (a)	Hog-wallow tract near Huffman's.	Merced	12	Grass, herbs	80.328	4.345	84.673	0.347	0.058	0.508	0.588	0.016	4.772	6.165	0.023	0.006	.....	3.278	100.434	4.21	15.0	Jaffa.
704	Fresno plains soil (a)	Central colony	Fresno	12	do	85.874	2.705	88.579	0.340	0.248	1.163	0.499	0.034	3.276	3.221	0.097	0.117	.....	1.789	99.363	2.22	15.0	Do.
586	Tulare plains soil (a)	East of "Outside creek"	Tulare	12	Wild flowers, grass	73.774	3.491	77.265	1.221	0.149	1.173	1.751	0.027	5.673	7.799	0.103	0.003	.....	4.351	99.515	4.62	15.0	Do.
573	do	Cross creek	do	12	do	66.079	3.378	69.457	1.817	0.436	4.307	1.585	0.078	6.041	8.692	0.138	0.263	2.533	4.150	99.497	8.74	15.0	Do.
700	Salt-grass soil (a)	Buena Vista slough	Kern	12	Salt-grass	87.060	1.980	89.040	0.492	0.305	1.198	1.069	0.025	5.822	0.171	0.079	0.133	.....	1.130	99.464	2.16	15.0	Do.
	FOOT-HILL REGION.																						
559	Red-loam soil	Redding station	Shasta	.....	Scattering oaks	76.274	4.102	80.376	0.500	0.041	0.104	0.403	0.009	6.686	8.480	0.036	0.012	.....	3.968	100.615	5.05	15.0	Do.
705	Red chaparral soil	Anderson	do	12	Chaparral, poison oak, small oaks, and brush.	63.384	5.480	68.864	0.417	0.052	0.288	0.207	0.037	7.705	14.443	0.047	0.074	.....	7.680	99.814	10.00	15.0	Do.
706	Red chaparral subsoil	do	do	12–22	do	63.194	4.710	67.904	0.467	0.044	0.327	0.350	0.029	6.263	17.434	0.064	0.043	.....	7.229	100.154	10.75	15.0	Do.

a Soils analyzed at expense of United States Census Office; all others at the laboratory of the College of Agriculture, University of California.

Chemical analyses of California soils and subsoils—Continued.

Number.	Soil title.	Locality.	County.	Depth.	Vegetation.	Insoluble residue.	Silica, soluble in Na$_2$CO$_3$.	Total insoluble residue and silica.	Potash.	Soda.	Lime.	Magnesia.	Brown oxide of manganese.	Ferric oxide.	Alumina.	Phosphoric acid.	Sulphuric acid.	Carbonic acid.	Water and organic matter.	Total.	Hygroscopic moisture.	Temperature of absorption C.°	Analyst.
	FOOT-HILL REGION—continued.			*Inches.*																			
499	Red upland loam soil	Wheatland	Yuba		Herbs; scattered poison-oak.	78.789	3.803	82.592	0.249	0.095	1.021	0.471	0.018	5.811	6.283	0.043	0.019	.....	3.644	100.186	4.81	15.0	Jaffa.
51	Red foot-hill soil	Auburn	Placer	12	Oak, pine, and chaparral.	.....	.....	69.520	0.380	0.070	0.960	1.090	0.390	12.420	10.970	0.160	0.010	.....	5.140	101.110	.....	15.0	Morse.
67	Mining slum soil	Near Chinese camp	Tuolumne	.....	Willows, grass	.....	.....	72.980	0.190	0.210	1.190	2.320	0.080	9.300	10.550	0.080	0.030	.....	4.430	101.360	.....	.....	Do.
68	Valley "adobe" soil	....do	....do	.....	Oaks	.....	.....	56.610	0.190	0.140	0.680	13.740	0.080	18.430		0.070	0.010	.....	9.840	99.790	.....	.....	Do.
190	Red-loam soil	Lagrange	Stanislaus	12	"Blue" and white oaks, poison-oak, grass, and flowers.	67.915	6.964	74.879	0.352	0.126	1.544	0.720	0.031	7.879	9.864	0.091	0.362	.....	3.766	99.614	5.42	15.0	Jaffa.
191	Red foot-hill soil	Merced Falls	Merced	10	Grass and "blue" oaks	73.352	4.506	77.858	0.375	0.125	0.351	0.840	0.066	6.964	8.804	0.067	0.221	.....	5.060	101.731	6.11	15.0	Do.
196	Red gravelly soil	Hog-wallows, 11 miles north of Merced.	....do	8	Grasses	79.078	5.544	84.622	0.208	0.111	0.394	0.361	0.033	3.903	6.660	0.053	0.082	.....	4.143	100.570	4.97	15.5	Do.
	SOUTHERN REGION.																						
332	Mojave desert soil	Mojave station	Kern	12	Sage-brush, creosote plant, grass.	70.965	4.999	75.964	0.928	0.078	1.787	1.782	0.026	5.478	9.227	0.056	0.012	0.456	3.903	99.697	10.76	15.0	Do.
130	Bench-land soil	San Gabriel valley	Los Angeles	.....	Grasses	.....	.....	81.120	0.270	0.170	0.680	1.770	0.100	6,300	6.790	0.160	0.070	.....	3.070	100.500	2.30	15.0	Morse.
382	Low mesa soil	Pomona	....do	12	Grass, alfilerilla	72.519	5.121	77.640	0.839	0.296	2.364	2.225	0.039	8.297	5.974	0.018	0.022	.....	2.550	100.054	3.46	15.0	Do.
381	Low mesa subsoil	....do	....do	12–32	Grass, alfilerilla	75.304	3.872	79.176	0.962	0.301	2.052	2.154	0.043	7.342	5.835	0.049	0.020	.....	2.546	100.480	2.37	15.0	Do.
47	Mesa land soil	National ranch	San Diego	.....	Grass, herbs	.....	.....	86.210	0.480	0.140	0.360	0.540	0.100	3.690	5.120	0.230	0.030	.....	2.600	99.500	2.36	15.0	Do.
506	Bottom soil (*a*)	Colorado river	....do	12	Mezquite trees, creosote plant, and arrow weed.	58.574	5.327	63.901	1.857	0.162	8.671	2.966	0.025	4.139	8.379	0.133	0.145	7.818	3.344	100.860	9.26	15.0	Jaffa.
	COAST RANGE REGION.																						
	South of San Pablo bay.																						
168	Valley soil (*a*)	Santa Paula	Ventura	12		85.664	1.847	87.511	6.634	0.070	0.759	0.593	0.025	3.350	3.095	0.200	0.003	.....	3.132	99.372	5.49	15.0	Do.
182	Reddish mountain soil	....do	....do	12	Grass, herbs	74.930	7.912	82.842	0.621	0.164	0.952	0.955	0.036	5.070	5.939	0.127	0.039	.....	2.669	99.414	6.59	15.0	Do.
170	Bench-land subsoil	Hollister's ranch	Santa Barbara	12–18	Oaks	53.065	4.678	87.743	0.506	0.058	0.561	0.666	0.055	3.116	2.995	0.223	0.094	.....	3.854	99.871	5.98	15.0	Do.
600	Upland soil	"Poverty Hill"	San Benito	12	Cultivated twelve years	85.596	2.567	88.163	0.333	0.109	0.676	0.526	0.048	2.856	4.214	0.027	0.015	.....	3.476	100.443	5.22	12.5	Do.
606	Upland loam soil	Soquel ranch	Santa Cruz	12	Cultivated	80.426	3.028	83.454	0.343	0.126	0.502	0.390	0.014	3.928	5.711	0.053	0.009	.....	4.955	99.485	5.60	15.0	Do.
702	Chaparral soil	Two miles northeast of Saratoga.	Santa Clara	12		57.449	5.114	62.563	0.859	0.260	1.987	2.428	0.098	10.019	9.516	0.139	0.063	.....	11.921	99.853	12.09	15.0	Do.
37	Valley soil	Pescadero	San Mateo	.....	Redwood, pine, oak, alder, buckeye, and madrone.	78.084	3.237	81.321	0.541	0.231	0.925	0.820	0.039	4.934	4.821	0.084	0.027	.....	6.757	100.500	7.38	15.0	Do.
680	Sandstone soil	San Francisco	San Francisco	8	Scrubby live-oak	78.135	3.458	81.593	0.675	0.080	0.846	0.780	0.053	5.682	5.162	0.031	0.053	.....	5.404	100.359	6.92	15.0	Morse.
682	Sandstone subsoil	....do	....do	8–18		70.224	5.532	75.756	0.590	0.172	0.399	1.221	0.059	7.368	9.737	0.011	0.022	.....	4.900	100.135	9.41	15.0	Do.
648	Black waxy adobe soil	Colton ranch	Contra Costa	12	Sunflower	50.900	0.020	50.980	0.102	0.741	2.471	0.890	0.065	11.090	15.689	0.057	0.045	Trace	8.304	99.524	13.51	15.0	Do.
692	Dark soil, rolling uplands.	Livermore valley	Alameda	6	Scattering white oak and poison-oak.	80.202	5.023	85.285	0.299	0.108	0.813	0.647	0.065	3.584	4.933	0.008	0.010	.....	4.047	99.857	5.67	15.0	Jaffa.
693	Dark subsoil, rolling uplands.	....do	....do	6–18	Scattering white oak and poison-oak.	80.658	5.157	85.815	0.357	0.121	0.693	0.666	0.025	3.647	5.329	0.062	0.008	.....	3.435	100.158	6.12	15.0	Do.
694	Red gravelly soil, rolling uplands.	....do	....do	8	Scattering white oak and poison-oak.	81.941	3.756	85.697	0.323	0.081	0.720	0.503	0.030	3.030	5.540	0.061	0.008	.....	3.550	100.193	4.53	15.0	Do.

649	Sediment soil	Arroyo del Valle, Livermore valley.	Alameda		Shrubs, herbs, and some sycamores.	71.156	4.938	76.094	1.143	0.123	2.049	3.046	0.044	5.648	7.153	0.117	0.101	1.004	3.679	100.201	5.67	15.0	Do.
1	Black "adobe" soil	University grounds	do	12–22	Live-oaks, large			77.844	0.452	0.074	1.050	1.211	0.078	4.675	7.788	0.231	0.077		5.718	99.198		15.0	Sutton.
2	Subsoil of No. 1	do	do	22–30	do			69.563	0.348	0.109	0.998	1.913	0.093	7.208	13.970	0.116	0.028		6.600	100.946			Do.
4	"Adobe" ridge subsoil	do	do	10–20	Scattered live-oak, small.			86.002	0.189	0.134	0.484	0.452	0.038	4.013	5.532	0.057	0.021		4.051	100.993			Do.
	North of San Pablo bay.																						
185	Valley soil	G. F. Hooper's vineyard.	Sonoma	12	Oaks and grape-vines	76.089	6.839	82.928	0.435	0.123	0.744	0.578	0.025	5.793	5.092	0.187	0.171		3.715	99.791	4.98	15.0	Jaffa.
188	Red mountain soil	do	do	12	Oaks, manzanita, chaparral.	34.392	14.110	48.502	0.319	0.058	0.670	0.712	0.146	25.955	12.160	0.166	0.274		11.640	100.602	13.71	15.0	Do.
207	Eel river bottom soil	3 miles east of Ferndale.	Humboldt	12		65.346	6.896	72.242	1.127	0.282	0.105	3.329	0.117	6.986	10.236	0.167	0.020		5.629	100.240	7.87	15.0	Do.
205	Subsoil of No. 207	do	do	12–25		69.373	3.588	72.961	1.134	0.120	0.101	2.239	0.054	7.307	9.758	0.141	0.026		4.665	99.506	6.21	15.0	Do.
676	Red volcanic soil	Flat on Clear lake	Lake	12	Not known	49.604	5.934	55.538	0.452	0.170	0.658	0.610	0.051	10.477	22.585	0.031	0.033		9.654	100.259	11.11	15.0	Morse.
672	Gray valley soil	2 miles south of Saint Helena.	Napa	12	Large white oak	77.017	3.340	80.357	0.746	0.477	0.600	1.331	0.041	5.656	5.671	0.101	0.050		5.252	100.282	4.50	15.0	Do.

a Soils analyzed at expense of United States Census Office; all others at the laboratory of the College of Agriculture, University of California.

Table of humus and its available constituents (percentages referred to the soils) found in California soils.

No.	Name.	Locality.	County.	Humus.	Available inorganic.	Available phosphoric acid.
563	Sacramento river alluvium	Rancho Chico	Butte	0.749	0.255	
517	Brownish loam soil	Biggs' Station	do	1.184	0.464	
110	Putah valley (middle land), cultivated	Dixon	Solano	1.709	0.562	
195	Valley soil	Merced ditch	Merced	0.867	0.595	
198	Merced river bottom soil	Hopeton	do	1.800	0.563	0.130
701	Dry bog soil	Sisson's ranch	Tulare	1.061	0.984	0.039
570	Brown adobe soil	Eisen vineyard	Fresno	0.597	0.373	0.020
579	Alluvial loam soil	Grangeville, Mussel slough	Tulare	0.644	0.587	
77	Dry bog soil	Tulare lake	do	0.468	2.184	
193	Loam soil	Hog-wallow tract near Huffman's	Merced	0.367	0.334	0.019
704	Fresno plains soil	Central colony	Fresno	0.604	0.351	0.011
586	Tulare plains soil	East of Outside creek	Tulare	1.139	0.535	
573	Tulare plains soil	Cross creek	do	0.906	0.740	
700	Salt-grass soil	Buena Vista slough	Kern	0.170	0.196	0.009
705	Red chaparral soil	Anderson	Shasta	1.420		
499	Red upland loam soil	Wheatland	Yuba	0.466	0.336	
51	Red foot-hill soil	Auburn	Placer	1.140	1.120	
67	Mining-slum soil	Near Chinese camp	Tuolumne	0.420	0.360	
68	Valley adobe soil	do	do	1.614	0.395	
190	Red-loam soil	Lagrange	Stanislaus	0.715	0.448	
191	Red foot-hill soil	Merced Falls	Merced	0.712	0.467	
196	Red gravelly soil	Hog-wallows 11 miles north of Merced	do	0.758	0.533	
332	Mojave desert soil	Mojave station	Kern	0.283	0.370	
382	Low mesa soil	Pomona	Los Angeles	0.324	0.263	
47	Mesa land soil	National ranch	San Diego	0.555	1.439	
506	Bottom soil	Colorado river	do	0.752	1.151	0.133
168	Valley soil	Santa Paula	Ventura	0.841	0.368	0.200
182	Reddish mountain soil	do	do	1.055	1.004	
170	Bench-land subsoil	Hollister's ranch	Santa Barbara	1.341	0.271	
600	Upland soil	Poverty hill	San Benito	0.819	0.284	
606	Upland loam soil	Soquel ranch	Santa Cruz	1.463	0.579	
37	Valley soil	Pescadero	San Mateo	2.850	0.625	
702	Chaparral soil	Near Saratoga	Santa Clara	3.096	0.884	
680	Sandstone soil	San Francisco	San Francisco	2.284	1.045	
1	Black adobe	Berkeley	Alameda	1.750		
643	Black waxy adobe soil	Colton ranch	Contra Costa	1.500	0.829	0.036
649	Sediment soil	Arroyo del Valley / Livermore valley	Alameda	0.396	0.413	
185	Valley soil	Hooper's vineyard	Sonoma	1.111	0.371	
188	Red mountain soil	do	do	2.537	1.171	
207	Eel river bottom soil	East of Ferndale	Humboldt	1.250	0.590	
205	Eel river bottom subsoil	do	do	0.652	0.427	
676	Red volcanic soil	Flat on Clear lake	Lake	1.442	0.393	0.614
672	Gray valley soil	Two miles south of Saint Helena	Napa	1.685	0.457	

MECHANICAL COMPOSITION OF CALIFORNIA SOILS.—The mechanical analyses thus far made of California soils are given in the table on page 83. The method of analysis was that described by the writer in 1873 (*a*), by the aid of the elutriator or soil-washer, devised for the purpose, and constructed for the University of California. Many important points of general interest are deducible from these analytical results, but their detailed discussion would lead beyond the limits necessarily assigned to the present report. Attention should, however, be called to some typical soils. Thus, soil No. 586 is fairly representative of the "plains soils" of the San Joaquin valley, with the exception of the Fresno region, showing that while these soils, on account of the coarseness of a large part of their mass, appear very sandy, yet they contain as much clay as would usually constitute a "light loam". Again, Nos. 1, 2, 6, and 110 exemplify the ordinary "black adobe" of the Coast range and great valley, modified in opposite directions in the cases of Nos. 8, 9, and 68, which are lighter, and No. 643, which is heavier than the average, the latter, in fact, becoming, like the "hog-wallow" of Mississippi (see report on that state), almost unmanageable under ordinary circumstances. No. 168 is the remarkable soil which allows an ax-handle to be pushed down to the head or the arm to the elbow without exertion, yet is so retentive of moisture as to need no irrigation. It does not differ widely in most respects from No. 51, the red foot-hill soil from Auburn, which, like the other, is found to be so admirably adapted to fruit-growing. Nos. 47 and 130 exemplify well the light loam soils of the southern region, on which the vine will grow without and other fruits with but little irrigation. The Colorado river bottom soil might be expected to be a somewhat heavy loam, but its large percentage of lime places it among the light loams. Again, between Nos. 8 and 9, one alkaline, the other not, the difference in mechanical composition is but slight, whereas, in consequence of alkali, No. 9 is practically untillable. These facts are referred to in the text in connection with the description of the several soils.

(*a*) *Am. Jour. Sci.*, Oct. and Nov., 1873; Jan., 1874.

Mechanical analyses of California soils and subsoils.

	ENTIRE SOIL.				FINE EARTH.												
	Weight of stones over 1.2 mm.	Weight of stones between 1.2 and 1 mm.	Weight of stones between 1 and 0.6 mm.	Fine earth.	Clay.	Sediment of <0.25 mm.	Sediment of < 0.25 mm.	Sediment of < 0.5 mm.	Sediment of < 1.0 mm.	Sediment of < 2.0 mm.	Sediment of < 4.0 mm.	Sediment of < 8.0 mm.	Sediment of < 16.0 mm.	Sediment of < 32.0 mm.	Sediment of < 64.0 mm.	Total.	Analyst.
No. 10.—Sediment soil, Sacramento river, near Sacramento.	None.	None.	None.	.....	12.062	36.682	6.927	18.111	13.665	10.267	3.163	0.322	.....	.....	.....	96.199	Sutton.
No. 6.—Black "adobe" soil, S. 45, Weber grant, near Stockton, San Joaquin county.	None.	.....	0.360	99.650	32.625	37.115	4.304	5.501	5.617	2.013	1.962	3.1450	2.106	1.285	0.437	96.130	Do.
No. 8.—Non-alkaline soil from Overhiser's, near Stockton, San Joaquin county.	0.400	.....	1.610	97.990	20.800	32.000	3.300	6.000	5.600	7.300	7.500	5.700	4.800	1.500	1.200	96.400	Do.
No. 9.—Alkaline soil from Overhiser's, near Stockton, San Joaquin county.	0.550	.....	2.140	97.310	24.600	26.100	3.300	9.400	6.200	6.200	5.400	4.800	4.700	5.900	1.100	97.700	Do.
No. 77.—"Dry bog" soil, southeast shore of Tulare lake.	.....	4.100	.....	95.900	29.793	13.840	1.567	2.195	8.183	8.622	9.722	6.641	2.115	2.407	1.275	a86.360	Morse.
No. 586.—Tulare plains soil, "Outside" creek, Tulare county.	.....	.....	.....	.....	10.481	23.119	1.329	2.155	10.644	6.151	7.907	7.640	7.991	11.112	8.686	97.221	Jaffa.
No. 51.—Red foot-hill soil, Auburn, Placer county.	.....	13.942	.....	86.058	13.911	28.963	2.941	5.570	11.392	15.953	19.454	3.516	1.121	0.265	0.161	94.247	Morse.
No. 67.—Mining slum soil near Chinese camp, Tuolumne county.	.....	1.850	.....	98.150	18.474	27.270	0.900	8.196	10.563	11.975	9.228	6.608	1.240	0.873	0.824	96.157	Do.
No. 68.—Valley "adobe" soil near Chinese camp, Tuolumne county.	25.330	5.804	4.749	64.116	26.100	35.580	0.835	3.987	4.791	5.974	4.450	5.440	4.229	2.877	3.202	97.465	Do.
No. 130.—Bench-land soil, San Gabriel valley, Los Angeles county.	7.720	4.730	5.070	82.470	10.700	16.320	1.330	6.590	5.020	7.090	13.100	8.390	10.050	11.390	7.550	97.530	Do.
No. 47.—Mesa-land soil, National ranch, San Diego county.	9.760	9.110	10.330	70.800	9.660	10.370	0.970	3.240	3.820	5.900	8.360	12.860	13.540	17.730	12.570	b99.020	Do.
No. 506.—Bottom soil, Colorado river, San Diego county.	.....	.....	.....	.....	23.969	30.999	0.790	11.278	12.640	8.382	2.513	0.752	0.107	0.147	0.131	c91.708	Jaffa.
No. 168.—Valley soil, near Santa Paula, Ventura county.	.....	3.530	.....	96.470	15.020	14.040	1.200	5.140	8.380	12.670	16.360	11.480	7.010	6.450	4.110	b101.510	Morse.
No. 1.—Black "adobe" soil, university grounds, Alameda county.	13.945	6.567	.....	79.498	31.980	24.600	1.170	3.400	4.770	7.490	6.200	0.870	2.780	7.660	5.440	96.310	Sutton.
No. 2.—"Adobe" subsoil, university grounds, Alameda county.	35.275	7.793	.....	56.932	33.530	22.120	6.030	5.940	7.000	6.420	7.930	3.990	1.840	0.210	0.020	95.030	Do.
No. 4.—"Adobe" ridge soil, university grounds, Alameda county.	13.233	4.607	.....	82.160	18.920	17.250	4.870	6.790	6.420	6.640	3.690	7.450	11.030	9.490	3.420	95.970	Do.
No. 188.—Reddish mountain soil, G. F. Hooper's vineyard, Sonoma county.	.....	.....	.....	.....	d52.242	14.685	1.053	4.877	6.096	3.605	5.090	4.368	3.275	1.047	0.449	96.787	Jaffa.
No. 110.—Valley soil, Putah creek, Solano county.	.....	.....	.....	.....	31.490	43.080	2.270	3.560	4.970	4.400	2.640	1.500	1.300	.....	.....	95.210	Morse.
No. 643.—"Adobe" soil, mount Diablo, Contra Costa county.	.....	3.200	.....	96.800	43.540	34.050	1.590	2.590	3.130	2.790	2.260	1.760	0.750	.....	2.230	94.690	Do.
No. 676.—Red-land soil, Lake county.	.....	30.320	.....	69.680	e29.840	29.950	1.440	3.730	6.060	6.020	5.970	5.390	3.880	4.070	2.130	98.470	Do.

a The low summation of this analysis is due to the dissolution of lime and some alkaline salts in the large quantity of water employed, the clay at first failing altogether to diffuse until these salts had been washed out. The loss bears mainly, of course, upon the fine sediments.

b This high summation is probably, to some extent, due to the turbidity of the water used for analysis, which added to the weights of the finest sediments.

c Low summation due to solution of lime salts.

d Containing about 25.0 of ferric hydrate.

e Containing about 11.0 of ferric hydrate.

PART II.

AGRICULTURAL DESCRIPTIONS

OF THE

COUNTIES OF CALIFORNIA.

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AGRICULTURAL DESCRIPTIONS

OF THE

COUNTIES OF CALIFORNIA.

[The descriptions which form this portion of the report are necessarily concise, rather general, and restricted almost exclusively to the topographical and agricultural features, as given in various published and unpublished sources referred to in the introductory statement. As these are to a large extent very deficient in regard to these points, dealing chiefly in generalities regarding settlement, products, and communication, much that should have been stated may be found wanting, and the statements given may not in all cases convey the correct impression. This is especially true of the descriptions of the mountainous portions of the state, the personal exploration of which did not come within the province of this work. Reference to towns and settlements is, of course, made here only casually in connection with the description of the natural features, which forms the object of this publication.

The arrangement of counties is by agricultural regions as already given in the first part of the report, and each county is described under the head of that region to which it predominantly belongs, and is described as a whole. When its territory is covered in part by several adjacent soil regions, its name will be found under each of the several regional heads in which it is concerned, with a reference to the one under which it is described. In the lists of counties placed at the head of each group the names of those described *elsewhere* are marked with an asterisk (*); and the reference to the head under which they are described will be found in its place in the order of the list in the text itself. In each region the counties follow each other as nearly in their geographical order as possible, and this order is indicated in the list.

The statistical matter forming the headings of the counties was obtained in part from the Census Office; the regional areas are only approximate.

To some of the county descriptions are appended abstracts from letters or descriptions (intended originally for the Paris exposition) from correspondents, and also abstracts from the report of Mr. N. J. Willson on the country through which the Southern Pacific railroad passes southward from Sacramento to the Colorado river. This latter report was furnished by the Central Pacific Railroad Company for the use of the Census Office.]

GREAT VALLEY REGION.

(Embraces the following counties and parts of counties: Butte, Tehama,* Colusa, Yuba, Placer,* Sutter, Yolo, Solano, Sacramento, San Joaquin, Contra Costa,* Stanislaus, Merced, Fresno, Tulare, and Kern.)

BUTTE.

Population: 18,721.

Area: 1,720 square miles.—Sacramento valley, 595 square miles (treeless adobe lands, 70 square miles); lower foot-hills, 965 square miles; higher foot-hills, 160 square miles.

Tilled lands: 304,677 acres.—Area planted in wheat, 127,189 acres; in corn, 1,325 acres; in oats, 418 acres; in barley, 23,288 acres; in vineyards, 570 acres.

Butte county is separated in part from Colusa on the west by the Sacramento river and Butte creek, these streams receiving the drainage from the western half of the county. Very near the heads of these small tributaries, and flowing in a general south but irregular course, is Feather river, whose tributaries are all on the eastern side. The surface of the county thus has the general appearance of two successive plains, both sloping westward; the one on the east, or the foot-hills, is broken and rolling and has Feather river at its foot; the second or the plains proper, rises rather abruptly from this river and slopes gradually and with a more even surface to the Sacramento river on the west. A large part of the latter plain, forming a belt from 12 to 20 miles wide along the Sacramento river and through the county, is quite level, and is embraced in the great valley region. It is the

chief farming portion of the county. Its surface is treeless, and its lands vary from the rich sandy loam of the rivers to the stiff black and gray adobe, which is underlaid by limy hard-pan at depths of from one to several feet. A large adobe tract lies between the railroad and the alluvial lands of the Sacramento river, and is liable to overflow in wet seasons. These lands are said to yield an average of 30 bushels of wheat or 45 bushels of barley per acre. The adobe lands are bordered on the east by a light, reddish loam, which is considered an excellent fruit and wheat land, and at some points bear an oak growth.

The line separating the valley from the foot-hills is said to be well defined, the surface of the latter being not only undulating and broken, but barren and stony, with an abundance of bowlders. This line passes about 3 miles east of Chico, and a short distance west of Oroville, into Yuba county, on the south. A belt of red land lies near the foot-hills. (For an analysis of this land from Bidwell's ranch, near Chico, see page 22.) The lands of the foot-hills region are generally of a red and gravelly clay character, destitute of trees, and on the hills are barren. The valley soils are better adapted to farming purposes. There is a belt of 8 or 9 miles width in the western portion of the foot-hills region, in which the soil is thin and apparently derived from eruptive rocks. This belt in some places has an elevation of 1,000 feet above the plain.

The northeastern and eastern parts of the county are broken with ridges and hills between the creeks, and are well timbered with pine, cedar, and spruce. Turpentine and resin are obtained from the pine forests. The county is comparatively well populated and under cultivation, the averages being 10.8 persons and 177.1 acres per square mile.

The Oregon division of the Central Pacific railroad connects the county with Sacramento on the south.

TEHAMA.

(See "Lower foot-hills region".)

COLUSA.

Population: 13,118.

Area: 2,500 square miles.—Sacramento valley, 1,275 square miles (including adobe, 100 square miles; tule land, 140 square miles); lower foot-hills, 580 square miles; Coast range, 645 square miles.

Tilled lands: 653,016 acres.—Area planted in wheat, 261,381 acres; in corn, 851 acres; in oats, 176 acres; in barley, 39,939 acres; in vineyards, 14 acres.

Colusa county lies in the western part of the great Sacramento valley, the Sacramento river in part forming its eastern boundary. Its western boundary-line lies upon the summit of the Coast range. The western third of the county is hilly, broken, and partly mountainous, and the general surface, falling eastward to the level valley lands of the Sacramento, is interspersed with narrow valleys along the many small streams that flow eastward, Stony creek, the largest of these streams, flowing northward and northeastward until it escapes from the foot-hills, when it turns eastward toward the Sacramento. That portion of the great valley north of Jacinto has a gradual fall to the Sacramento river, and its lands are chiefly a reddish gravelly loam, quite similar to that of the foot-hills. The rest of the valley, or the part south of Jacinto, has a gradual fall to what is termed the basin, or "trough", a low, trough-like depression, partly of tule lands, lying 3 or 4 miles west of the river, and receives the waters of the western streams. From the basin to the river there is a rapid rise, and eastward of the river a fall to another basin or depression of Butte creek; so that the river has the appearance of flowing along the summit of a low ridge. The lands of this river section between the basins comprise the rich alluvial loams that in other counties southward form so prominent a feature of the valley, and have a natural timber growth of cottonwood, sycamore, and ash.

The tule lands along the sloughs in this county are estimated to cover about 30,000 acres, and are excellent meadow lands. They are low, flat, and ill-drained, and are generally regarded as unproductive or irreclaimable, though crops of grain and cotton have been raised on them after proper drainage and protection by levees from the overflow of the river and other streams. The high land between Sycamore and Dry sloughs is called Mormon basin, and embraces rich lands, which yield about 50 bushels of wheat per acre.

The great valley (which includes also the tule and river lands) is a broad, level plain, open and almost entirely destitute of trees, and to the foot-hills has a width west of the river varying from 15 to 20 miles. The soil is chiefly a loam or sediment from the hills, that from one mile north of Willows to the Tehama county-line being reddish and gravelly in character. These valley lands are largely in cultivation, and yield large crops of wheat, the principal crop of the county. Much alkali land occurs in spots in the region lying between the two tule-land belts east and southeast of Williams. The small streams have shallow valleys, with silty or sandy alluvial soils, and are separated from each other by low ridges of brownish-gray adobe, which is often humpy or hog-wallow in character, and has more or less alkali in the depressions. These are called "goose lands". W. S. Green, of Colusa, says of this land:

> All the creeks that run from the foot-hills in winter run on ridges. Between these ridges we sometimes have low, flat land with imperfect drainage, so that the water chills the soil; and as it goes off by evaporation it leaves all the salts near the surface, and when entirely dry it is more or less encrusted with alkali. In winter there are ponds on this land around which the geese congregate, and as it was considered worthless for anything else it was called "goose land". It is now found, however, that drainage and cultivation improve this land, and a great deal of what was called "goose land" now produces good crops.

The foot-hills which lie between the valley and the mountains and become more and more broken westward are partly covered with an oak growth and partly with brush, chamisal, and laurel. These hills are chiefly devoted to grazing purposes, and their lower valleys embrace almost the only farms of the region. The low hills capable of cultivation are thought to cover about 700 square miles, while the estimated area of the foot-hill valleys is about 200 square miles. Of the latter, Bear valley, within 2 miles of the Lake county-line, has a width of from 1 to 2 miles and a length of 10 miles, its elevation above the plains being about 1,000 feet. There are some wheat farms in the eastern part of this valley, but the western portion is hardly under cultivation.

The upper part of Cortina valley also is rough and unproductive, while the lower, near the plains, is of a better character, and is partly under cultivation.

Indian valley, in the northwestern part of the county, has a length north and south of about 30 miles and a width of 5 miles on the north, but becomes very narrow on the south.

The soil of the foot-hills is red and gravelly, more or less rocky, and is especially adapted to fruits. The mountains of the Coast range are too high for farming purposes. Pine is their chief timber growth.

The lands of Colusa under cultivation average 261.2 acres per square mile, the county ranking as ninth in the state in this regard. The average of population is but 5.2 persons. The California Pacific railroad connects the county with San Francisco and Sacramento.

YUBA.

Population: 11,284.

Area: 700 square miles.—Sacramento valley, 285 square miles; lower foot-hills, 415 square miles.

Tilled lands: 110,839 acres.—Area planted in wheat, 28,134 acres; in corn, 603 acres; in oats, 1,461 acres; in barley, 11,057 acres; in vineyards, 618 acres.

Yuba is a comparatively small county, and lies on the eastern side of the Sacramento valley, reaching from Feather river northeastward to the foot of the high Sierra. Its extreme western part, bounded on the south by Bear river, is intersected by Yuba river, and is largely included in the great Sacramento valley. The country embraced in the angles formed by the junction of these two streams with Feather river, the western boundary, is very level, and is intersected with small streams or sloughs. Along the rivers the lands, though formerly much above high water, are subject to overflow, the mining *débris* from the hills having in late years so filled up the channels as to cause the waters to spread out over the adjoining bottoms at every slight rise. These lands, once the richest in the county, are now so covered with this *débris*, or slickens, as to be "only a swamp of willows, cottonwood, and vines; a waste where bars of white sand and pools of slimy water glisten through the sapling's. At high water the thick and muddy waters of the river are spread out over a wide region of level country, sometimes a mile or even three miles wide, once the richest farming lands of the region, but now deserted, leveed in, and covered with mountain mud, sand, and pebbles". Marysville is now surrounded by levees so high as to preclude a view of the surrounding country, giving it the appearance of a walled city of the Old World.

The great valley in this county passes about 10 miles east of Marysville and southeast to the corner of the county. Its surface is quite level and treeless, with a soil well adapted to the culture of small grain, and is the chief farming portion of the county.

The foot-hills region, which reaches from the valley eastward nearly, if not quite, to the county limit, is at first rolling, but becomes more and more hilly, brushy, and rocky as the Sierra mountains are approached. Small valleys occur among the hills, but the lands are as yet but little under cultivation. The soils of the foot-hills are red and pebbly clays, and in the lower portions are well adapted to fruits and grapes. The northeastern part of the county is rugged and broken. The farming portion of Yuba county is estimated to embrace not more than one-third of the total area, the remainder being devoted to grazing and mining purposes.

The lands of the county under cultivation average 158.3 acres per square mile, while the population has an average of but 16.1 persons.

The Oregon division of the Central Pacific railroad connects the county with Sacramento on the south.

PLACER.

(See "Lower foot-hills region".)

SUTTER.

Population: 5,159.

Area: 580 square miles.—Sacramento valley, 530 square miles (including tule lands and some adobe); buttes, 50 square miles.

Tilled lands: 171,856 acres.—Area planted in wheat, 74,338 acres; in corn, 1,596 acres; in oats, 243 acres; in barley, 14,830 acres; in vineyards, 169 acres.

Sutter county, bounded on the west by the Sacramento river and on the east in part by Feather river, lies entirely within the eastern part of the great valley of that river, its eastern boundary-line not reaching even the foot-hill region of the Sierra mountains. Between the two rivers, with the exception of Butte slough, in the southeastern part of the county, there are no streams, the country being apparently without drainage. Bear river and several creeks flow westward, but disappear before reaching the rivers.

The surface of the country is very level, the only exception being a region in the northwest having a diameter of about 12 miles, in which appear a number of high, prominent, and craggy isolated peaks or buttes of basaltic rock rising more than a thousand feet above the open plains, whose northern sides only are covered with a scrubby growth of oaks and pine. The border of this region consists of low, rolling foot-hills, whose lands are mostly devoted to pasturage. On the north and east are meadow lands, embracing, it is thought, about 10,000 acres, naturally subject to overflow, but largely reclaimed, while on the south and west there are marshes and tules, which extend southward in a belt several miles wide, nearly bordering the Sacramento river through the length of the county. The drainage of these hills is through Butte slough, at their southern foot, which also in time of high water connects the Sacramento and Feather rivers. The immediate river lands of both the Sacramento and Feather rivers are alluvial loams, timbered with a growth of cottonwood and sycamore, which, with the exception of some scattering oaks on the plains, is the only timber of the county.

The lands of the Sacramento river are highly productive and largely under cultivation, as are also those of other smaller streams, while in the case of Bear and Feather rivers the originally rich alluvial lands on each side of the river for a width of 1½ miles have been to a great extent covered with a slickens deposit of 2 or more feet. The

lands of the rest of the county are mostly dark loams, with some red gravelly clays on higher spots, yielding in their original condition an average of 25 bushels of wheat per acre. Stiff adobe tracts extend both north and south for some distance from the foot of the buttes and occur in the low grounds south of Yuba city and along the tules, and are said to yield from 30 to 40 bushels of wheat per acre.

The lands of Sutter county under cultivation average 296.3 acres per square mile, the county ranking fifth in the state; the average population is 8.8 persons per square mile. The Oregon division of the Central Pacific railroad runs through the county to Sacramento, on the south. The Sacramento river is also navigable for boats from Marysville southward, and furnishes transportation facilities to Sacramento and San Francisco.

ABSTRACT FROM A DESCRIPTION BY GEORGE OHLEYER, OF YUBA CITY.

The surface of the county, except that portion in the northwest where the buttes occur, is level. Most of it is also liable to overflow in extreme wet winters, and levees have been built to protect the lands, with, however, only partial success. Our streams originally ran in deep channels, and the Sacramento river above the confluence of the Feather river does so yet; but Feather river and the lower Sacramento have largely filled with *debris* from the mines. Bear river now has no channel, its original deep one having been filled entirely, as also the adjacent bottom land to the depth of many feet. The Butte mountains are covered on their north side by a scrubby growth of oak and pine, but the south sides have very little or no timber. The mountains being little else than rocks, no cultivation is attempted, but they afford good pasturage during winter and early spring. In wet winters these mountains are nearly surrounded by water, which on the west and south remains till late in the summer, forming tule and marsh lands.

The lands of the county embrace the following varieties: *red gravelly clay uplands*, which endure drought better than excessive wet seasons, and *dark sandy uplands*, with clay subsoil and hard-pan, the latter generally from 1 to 10 feet deep. Where no hard-pan exists the soil is usually about 6 feet deep, underlaid by quicksand, and then by cement. These lands are best adapted to wheat, endure drought and wet better than any other, are easily cultivated, and were originally covered with oaks. All kinds of fruit and ornamental trees grow to perfection. *Alluvial bottom lands*, best for corn and barley, are extensive. *Adobe lands* occur chiefly along the tule swamps and around the Butte mountains, and are productive when not too wet or too dry. Wheat is the chief production of the county; barley, corn, potatoes, etc., are also produced. Irrigation is not practiced. Hard water is generally found 10 or 15 feet from the surface.

YOLO.

Population: 11,772.

Area: 940 square miles.—Sacramento valley, 610 square miles (including tule land, 250 square miles); lower foot-hills, 170 square miles; Coast Range mountains, 160 square miles.

Tilled lands: 278,983 acres.—Area planted in wheat, 115,369 acres; in corn, 714 acres; in oats, 55 acres; in barley, 18,320 acres; in vineyards, 757 acres.

Yolo county is bounded on the east by the Sacramento river and on the south in part by Putah creek, which rises in the hills of the Coast range. Its surface is drained by but few streams, and of these Cache creek, in the middle, is the most important. This creek enters the county from Clear lake, on the northwest, flows eastward through narrow cañons for 12 or 15 miles, thence southeast through the broad Capay valley to Langville, whence it turns eastward through the more level lands and plains to the tule lands, and disappears before reaching the river. Water for irrigating purposes is supplied from this creek by ditches to a large region of farms on either side.

From the Sacramento river westward across the tule and the level plains the surface of the country rises to the lower hills of the Coast range, which appear abruptly along the western border, rising to about 1,500 feet above the sea. The county thus possesses the soil varieties usual to the country lying between the Sierra and Coast Range mountains.

The tule lands in the eastern part of the county, with a width of from 5 to 10 miles, are separated from the river by a narrow belt of bottom lands having originally a rich alluvial soil, but now covered with a thick deposit of mining *débris* brought down from the foot-hills. A part of this belt is known as Grand island. The timber growth of both this and the bottom land of Cache creek is chiefly cottonwood, sycamore, and willow. Westward from the tule lands the surface for many miles is very level, comprising a part of the great plain, with its very deep and rich alluvial loam, and is mostly under cultivation in grain and fruits. The central part of this region, from a short distance south of Woodland for several miles to the north and west, is timbered with wide-spreading oaks, while the rest of the plains, and even of the county, is comparatively treeless. In the northern part of the county the plain is limited on the west by a line of low hills, lying about 3 miles west of the railroad, and reaching from the northern boundary south to Cache creek, the extreme southern point appearing on the south of the creek about 4 miles from Woodland, and covering there an area of 2 or 3 square miles. This belt is 3 or 4 miles wide, and is all well adapted to cultivation, the soil being a dark gravelly loam, interspersed with tracts of red lands. It is not timbered, and to the northward, in Colusa county, it flattens out, and has a gravelly soil, with a stunted growth of white oak and chamisal.

On the west of the belt is what has been termed a hollow, or Fairview valley, some 2 or 3 miles wide, reaching south to within a mile of Cache creek, and embracing fine wheat lands. This valley is separated from Capay valley on the west by the low Coast Range mountains.

The country south of Cache creek is mostly a level and treeless plain (excepting around Woodland), and its soils are dark loams, nearly all under cultivation. A belt of adobe lands, somewhat lower than the plains, reaches from Madison, near the foot-hills, eastward within one and a half miles of Cache creek and 8 miles south of Woodland; "it has a width of a little more than a mile, and forms a drainage sink from the cañons of the mountains to Willow slough."

The county has an average population of 12.5 persons per square mile, while the lands under cultivation comprise 46.3 per cent. of the area and average 296.6 acres per square mile, thus placing the county fourth in rank in the state, and but very little ahead of Solano and Sutter. It is one of the raisin-making centers of the state.

The county is connected with Sacramento and San Francisco by railroad.

DESCRIPTION BY R. B. BLOWERS, OF WOODLAND.

The surface of the valley in this part of the county shows evidence of deposit from the sources of Cache creek, which drains quite a large tract of mountain country and Capay valley before coming out on the plain. The valley south of Woodland is interspersed with slight ridges, in the centers of which are found light soils, sand and gravel, the latter mostly at a depth of from 4 to 8 feet. The soil on either side of these ridges is a light sandy loam, gradually and almost imperceptibly changing to a heavy clay loam at a distance of from 1 to 1½ miles. The former soil comprises the best fruit land of the county, its slight elevation above the valley being just sufficient to facilitate irrigation.

SOLANO.

Population: 18,475.

Area: 940 square miles.—Sacramento valley, 625 square miles (including tule land, 205 square miles); Coast Range mountains, 315 square miles.

Tilled lands: 278,596 acres.—Area planted in wheat, 107,588 acres; in corn, 443 acres; in oats, 127 acres; in barley, 32,222 acres; in vineyards, 1,638 acres.

Solano county forms the southwestern end of the Sacramento portion of the great valley, which occupies the eastern part of the county. The western boundary lies in part along the Coast range, whence the surface gradually slopes eastward, southward, and southwestward.

Putah creek forms the northern and Sacramento river the southeastern boundary, while within the county there are but few creeks of any importance. The county embraces tule lands along the bay and streams, a level and open treeless valley over its eastern part, and a rolling foot-hill region over the western, the latter including rounded and prominent hills, with intermediate valleys of rich clay soils. The hills and valleys are treeless, and very little timber is found anywhere in the county. The lands have been classified by the county tax assessor as follows: First class, agricultural lands for fruit, 50,000 acres; second class, for grain, 250,000 acres; third class, reclaimed swamp and overflowed lands, 200,000 acres; fourth class, partially reclaimed swamp and adjacent uplands having an alkali soil, 75,000 acres; fifth class, swamp and overflowed lands and high and unproductive mountain ranges, the remainder.

One of the most prominent agricultural features of the county is what is known as the "Vacaville fruit region", reaching from Vacaville north to Putah creek, and embracing Vacaville and Pleasant valleys and the adjoining foot-hills, its length being about 12 miles, and its width from 1 to 3 miles. Vacaville valley slopes from the hills in a south and southeast course, while Pleasant valley slopes northward, each opening out into the Sacramento plain. A part of the region is in what is known as the thermal belt of the Coast range, a location of a few hundred feet above the Sacramento plains and above frost limits. The southern part of the region is cut off from Suisun bay on the south by the Montezuma hills, a succession of low, rounded hills, which extend eastward beyond the railroad. They have chiefly an adobe soil, partly under cultivation in wheat. There is some adobe land around Vacaville, but otherwise the soils of the belt are a dark loam.

Green valley, north of Benicia, is about 11 miles long and 5 miles wide, and is bordered southward by high rolling uplands, which at some points fall off steeply into Suisun and San Pablo bays. Mare island, the site of the United States navy-yard, is opposite the thriving town of Vallejo, and is separated from the mainland by Napa slough. Its southern end presents a bold and rocky headland, projecting into the bay, and falling off gradually to the northward into a broad expanse of tule lands. The valley lands around Vallejo are partly adobe, while those of the adjoining hills are dark sandy loams; light-colored calcareous clays underlie some of the lands.

The foot-hills of the county are partly covered with a scattered growth of oaks, horse-chestnut, buckeye, etc., and where not too steep or broken are partly under cultivation.

The lands of the Sacramento valley, or eastern portion of the county, are the dark loams, often adobe in character, belonging to the higher portions of the great valley. These lands are almost treeless and very level, and are cut occasionally by arroyos or ravines. The greater part is under fence and cultivation, the chief crop being small grain. The lands of Putah Creek valley embrace *low* and *middle* lands of rather stiff loam soils, and *high lands*, lighter in character, and 2 or 3 feet above the latter. These are described below by the correspondent, and an analysis of the middle lands will be found on page 22.

The average population of the county is 19.6 persons, and that of lands under cultivation 296.3 acres per square mile. In the latter regard the county ranks as fifth in the state, and this average is the same as that of Sutter, and but three-tenths of an acre below that of Yolo.

Transportation facilities to San Francisco and Sacramento are afforded the county by the California Pacific and Northern railroad, which passes through from east to west, and by a branch road from Elmira to Vacaville and Winters on the north. Ships also can reach Benicia and Vallejo through the bay and receive their cargoes of grain direct from the warehouses at these points.

ABSTRACT FROM A DESCRIPTION BY J. M. DUDLEY, OF DIXON.

The section described lies in the northern part of the county, along and south of Putah creek, extending eastward from near the foot-hills of the Coast range for a distance of 10 or 12 miles and varying in width (southward from the creek) from 2 to 12 miles. It is intersected by several dry sloughs or "arroyos", which run nearly parallel with each other from northwest to southeast. The land is highest along the banks of these arroyos, but otherwise the whole tract is quite level, and has a slight fall toward the southeast, which affords good drainage without washing or gullying.

There is no timber growth, except a few scattering oaks along Putah creek, and occasionally a few dwarfed elder bushes. There is a natural growth of wild oats, alfilerilla, wild clover, and *Eschscholtzia Cal.*, with occasional patches of bunch-grass.

The soils of this region are rich and deep, and embrace three chief varieties, *low*, *middle*, and *high* lands—the first two dark loams, the last a lighter loam, and all very productive. There is some adobe in small tracts in the lowest parts of the surface away from the creek.

The crops comprise wheat and barley, with small patches of alfalfa, which does not grow remarkably well. The yield of wheat and barley on land after ten and twenty years' cultivation is as great as at first. Summer-fallowed land yields from 35 to 40 bushels of wheat, while winter-sown wheat yields about 25 bushels per acre. The average of barley, if winter-sown, is about 40 bushels per acre.

Abundant water for common purposes is obtained in wells, which are dug from 30 to 90 feet deep, the water then rising and remaining at from 16 to 25 feet from the top. The water is hard, and is usually found in a quicksand stratum.

ABSTRACT FROM A DESCRIPTION OF THE VALLEJO REGION BY G. C. PEARSON, OF VALLEJO.

This region is bounded on the north by Napa valley, east by Suisun bay, south by Carquines straits, and west by San Pablo bay, and embraces from 90,000 to 100,000 acres. The only outlet to the ocean for the waters of the great valley is through Carquines straits, which has a width of about a mile and a length of 8 miles. This gateway not only affords easy railroad facilities for reaching the ocean shore, but is also an immense aerator, the ocean winds from May till November blowing daily and strongly through this pass into the valley on the east, thus tempering the heat of summer, which would otherwise be oppressive. The fogs brought from the bay by these winds apparently pass no further inland, but are piled up in fog banks upon the sides of the mountains on the north and south and against the highest points of the ridge intersecting this gap. With an average temperature of 70° in summer and 55° in winter, and almost surrounded by water which has a tidal service of from 4 to 6 feet, vegetation is seldom seriously affected by frost. Flowers bloom continuously, and vegetable gardens yield good returns at all seasons of the year for the labor bestowed on them.

A rocky ridge, running northwest and southeast near the center, renders a small portion of the district rough and broken; elsewhere it is undulating, diversified by rounded hills, cozy valleys, and open plains sloping gradually from the central ridge to the level of the bays on the east and west. The district is well watered by springs and streams flowing from them. Good and sufficient water is obtained in wells from 10 to 80 feet from the surface, and a noticeable feature is that at tide-level much deeper wells are required to secure an unfailing supply than upon the uplands or even hilltops. The soil varies in thickness from 1 to 6 feet on the hills and sloping ground to about 8 and 10 feet in the valleys. In the valleys, where unmixed with sand from the hills, the soil is a black tenacious adobe, and upon the uplands a clay loam; both are durable and excellent for grain or grass. The crops comprise the cereals and fruits, the latter including apples, pears, plums, figs, oranges, and grapes.

SACRAMENTO.

Population: 34,390.

Area: 1,000 square miles.—Sacramento valley, 935 square miles (including tule land, 245 square miles); lower foot-hills, 65 square miles.

Tilled lands: 304,627 acres.—Area planted in wheat, 44,123 acres; in corn, 3,928 acres; in oats, 871 acres; in barley, 30,547 acres; in vineyards, 1,938 acres.

Sacramento county is bounded on the west by the river of the same name and on the south in part by the Mokelumne river, and lies almost entirely within the great valley.

The American and Cosumnes rivers are the two other most important streams of the county. These rivers rise among the mountains of the adjoining eastern counties and flow southwestward, the former to the Sacramento river at Sacramento city, and the latter to the Mokelumne river on the south. Several creeks are tributary to these streams.

The county includes on the extreme east a belt of foot-hills from 6 to 8 miles wide, Folsom being on its western limit; but otherwise the surface has only gentle undulations, and is watered by streams flowing into the marshes of the tule lands, through which their waters reach the Sacramento river by many channels. "The main Sacramento river (also separating, as it flows south, into diverse branches or sloughs, some of which are very intricate) runs across the broad tule bottoms in crooked channels, cutting them up into numerous small and several large islands." Along the border of this river there is a belt of alluvial land varying in width from one-half mile to a mile or more, originally timbered with cottonwood and sycamore, which is almost entirely under cultivation.

A lower region or belt of tule lands borders this on the east, which is quite narrow in the northern half of the county, but expands to a width of 15 miles on the south. Portions of these lands have been reclaimed or protected from the overflow to which they are subject and are under cultivation, but the greater part is used as pasture land; thence eastward the surface gradually rises to the foot-hills, from whose spurs diverge broad, low ridges of reddish loam soil, gravelly near the hills, alternating with swales having a soil somewhat heavier and less deeply tinted, these undulations being perceptible far into the plain. When fresh, the lands of this plain produce 30 bushels of wheat per acre; they are, however, chiefly devoted to fruit culture. Southeast of Sacramento the red lands are underlaid by a porous and soft material at from 2 to 6 feet, and this by an impervious clay. The belt of foot-hills is rolling, interspersed with low hills, and its soils are red and gravelly clays, having a scattering growth of oaks. A few mountain spurs from the Sierra enter the county.

The lands of the county under cultivation average 304.6 acres per square mile, a number exceeded only by San Joaquin county. From the city of Sacramento railroads reach east, west, north, and south, and the river is navigated by steamers both above and below.

ABSTRACT FROM A DESCRIPTION BY GEORGE RICH, OF SACRAMENTO.

After passing the lowlands of the river, comprising rich black-loam soils, we reach a high bench of red land of various depths. Still eastward the country rises gradually, and we pass over various soils, such as red lands, adobe, clay loams, and sandy lands, with gravelly lands upon the higher plateaus of the foot-hills, until we reach the mountain ranges, interspersed with rich valleys.

The surface of the great valley is sloping, scarcely perceptible to the eye, and very open, with here and there a clump of oak trees. It is covered with a natural growth of grass, and in spring time is a bed of flowers. The soil is from 1 foot to 5 feet deep, resting on a hard-pan from 10 to 40 feet deep. The winter rains do not wash the lands much, and the surface is wavy, with little hillocks here and there, the water being carried off readily. In places the mounds are from 10 to 15 feet above the plain. There is little natural timber in the county. The chief crops are small fruit, vegetables, hay, barley, and wheat. Good virgin lands have produced 30 bushels of wheat, 25 bushels of oats, or 1½ to 2 tons of hay per acre. Alfalfa is raised in large quantities on the river bottoms.

ABSTRACT FROM A DESCRIPTION BY DANIEL FLINT, OF SACRAMENTO.

The Sacramento valley is about 30 or 40 miles wide, and Sacramento city is about 75 miles from the summit of the Sierra mountains. The soil of the valley is of a reddish color, and overlies a hard-pan from 2 to 6 feet from the surface. The river lands are partly a clayey, sandy loam of great depth and richness. The native timber embraces several varieties of oak, willow, cottonwood, and sycamore. The Sacramento and American rivers are leveed to afford the city protection from overflow.

SAN JOAQUIN.

Population: 24,349.

Area: 1,360 square miles.—Great valley, 1,210 square miles (including adobe, 310 square miles, and tule land, 320 square miles); lower foot-hills, 50 square miles; Coast Range mountains, 100 square miles.

Tilled lands: 460,342 acres.—Area planted in wheat, 201,461 acres; in corn, 2,333 acres; in oats, 130 acres; in barley, 32,669 acres; in vineyards, 674 acres.

The eastern portion of San Joaquin county lies in the foot-hills of the Sierra, while the extreme southwestern part rests upon the Coast Range mountains, the central and greater area being thus included in the great valley of the San Joaquin river, which stream flows northwestward, the Sacramento river forming the northwest boundary of the county. Other large streams, such as the Mokelumne, Calaveras, and Stanislaus rivers, all flowing westward, drain the eastern part of the county, and several streams occur on the west. The surface of the country, with the exception of the two extremes mentioned, is quite level, and is dotted over with a scattering growth of white and a few live oaks as far south as French Camp slough, beyond which there is but an open plain from the San Joaquin river eastward for 15 miles. The larger streams are mostly lined with a growth of cottonwood, willows, and sycamore.

This county, situated as it is at the point where the Sacramento and San Joaquin plains unite, or rather at the foot of each plain and in the center of the great valley, naturally possesses a variety in its agricultural features. The lands of each valley are to some extent represented, and we find on the west, along the rivers, a broad region of tule lands and marshes, on the east the foot-hill belt, extending through the county, while in the broad valley plain the alluvial loams of the Sacramento valley reach southward nearly to Calaveras river, and the sandy lands of the San Joaquin valley extend northward as far as French Camp slough, the two being separated by a broad belt of black loam and adobe lands reaching from the foot-hills westward to the tule lands.

Tule lands.—West of Stockton to the county-line, and from a point some fifteen miles south to the northwest corner, there is an immense tract of tule lands (estimated at 200,000 acres), through which the San Joaquin and Sacramento rivers find their way in many channels to their junction and to Suisun bay. Numerous islands occur in this region, but are subject to overflow from the rivers; they have rich soils, and when properly leveed are under cultivation. Robert's island, with its area of about 67,000 acres, is the largest. Eastward the tules are not so low, and by a system of levees they have been largely reclaimed and are under cultivation.

The valley lands.—A strip of sandy alkali lands, with a width in places of about 1½ miles, borders the tules on the east. It is covered with salt-grass and a scattering willow growth.

The northern part of the valley, from the county-line south to within 2 miles of Calaveras river, has a sandy loam soil, quite deep, and is watered by Mokelumne river, whose wide bottom land is timbered with willows, sycamores, and oaks. The surface of the country is very level, gradually rising eastward to the foot-hills, and is dotted over with a growth of white and some live oaks. This growth is said to have been originally very dense, but the entire country is now under fence and has been cleared. As the foot-hills are approached the lands become darker and richer and form a plateau some 15 or 20 feet above the river bottoms. The western part of this sandy loam country is the great watermelon region of the state, but small grain is produced abundantly. The eastern portion has been but recently furnished with transportation facilities by the building of the San Joaquin and Nevada railroad.

The central portion of the valley, as has already been stated, is a black loam or adobe region, and forms the divide between the two great valley regions, reaching from the foot-hills westward to the tule lands of the rivers. Its surface is very level, dotted over with scattered white-oak trees, is almost entirely under fence, and is largely under cultivation. The northern limit of the adobe region lies 2 miles north of Calaveras river eastward to the foot-hills; the southern limit is along French Camp slough for several miles, and thence southeast to Farmington and Oakdale, in Stanislaus county. The western part of the region has a width of about ten miles, in the middle of which is the city of Stockton. The adobe soil is said to be from 5 to 10 feet deep, and is interspersed with tracts of a light loam, which yields about 30 bushels of wheat per acre. A strip of alkali land reaches from the border of the tules, near Stockton, northeastward to the Calaveras river, a distance of about 14 miles. Its width is from 1 to 2 miles, though within this belt it occurs only in spots or small tracts a few inches below the general level of the adobe lands, often covered with salt-grass, and entirely unproductive.

The southern part of the valley, or that portion lying south of French Camp slough and west from the San Joaquin river to the black lands of Farmington, is level, sandy, and treeless, mostly unproductive unless irrigated, and is the extreme northern representative of the similar lands of the San Joaquin plains of the counties south. On the west of the river, to the Coast range, and south of the tules, these sandy lands also occur, interspersed with much black adobe, and from lack of irrigation facilities are also uncultivated.

The *foot-hills* form a narrow belt within this county along the eastern boundary, the change being so gradual from the valley proper into the undulations that are first observed that the line of separation is with difficulty defined. Clements, Bellota, and Farmington are, however, near this line, which thus makes a curve eastward, and, after passing Farmington, turns again southeastward into Stanislaus county. Its surface is rolling and mostly broken, its hills partly covered with trees and brush, and have red, gravelly soils; the valleys are mostly treeless, except along some of the creeks, and have soils varying from dark or light loams to red gravelly lands. Beds of rounded bowlders often fill the beds of the creeks. In the southern part of the region the red lands seem to predominate. This foot-hill region is but little under cultivation.

The county is comparatively well settled, the average being 17.9 persons per square mile, while in the percentage of lands under cultivation (52.8) it ranks highest in the state, with an average of 338.4 acres per square mile. Wheat and barley are the chief crops, and transportation is afforded by the Southern Pacific railroad to San Francisco and Sacramento, as well as across the continent to the Atlantic states.

ABSTRACT FROM THE NOTES OF N. J. WILLSON, OF THE SOUTHERN PACIFIC RAILROAD.

The surface of the country around Lathrop is slightly rolling, with dark loam and hog-wallow lands. In low places there is some alkali soil. The greater portion of the country is underlaid by hard-pan at depths varying from 6 inches to 30 feet below the surface. The altitude of Lathrop is 25 feet above the sea. The natural vegetation is alfilerilla, clover, wire and salt grasses. At Morano station, altitude 50 feet, the lands are slightly rolling, though generally level, and are quite sandy, drifting considerably, and very deep. They have a growth of clover, alfilerilla, and some salt and bunch grasses. Southward to the Stanislaus river the country rises to an elevation of 70 feet, the lands being still sandy. The river lands have a growth of oak and willow. The rain winds of the county come from the southeast, and dry winds from the northwest.

CONTRA COSTA.

(See "Coast Range region, south of San Pablo bay".)

STANISLAUS.

Population: 8,751.

Area: 1,420 square miles.—San Joaquin valley, 925 square miles (including adobe, 100 square miles, and tule land, some); lower foot-hills, 140 square miles; Coast Range mountains, 355 square miles.

Tilled lands: 417,511 acres.—Area planted in wheat, 172,445 acres; in corn, 378 acres; in barley, 19,559 acres; in vineyards, 99 acres.

Stanislaus county lies across the great valley of the San Joaquin, its eastern border being among the foot-hills of the Sierra, and its western resting on the summit of the Coast Range mountains.

The great valley, which thus occupies the central portion of the county, has a width of about 35 miles. On its western side the San Joaquin river flows northwestward, being joined on the east by the Tuolumne river, occupying the central part of the county, and by Stanislaus river, which forms in part the northern boundary, both having their sources among the mountains of the east. The western slope is drained by several creeks. The San Joaquin river is bordered by a belt of tule lands from 1 to 2 miles wide, while the adjoining lands for a distance of from 1 to 5 miles on the east have adobe valley soils, more or less interspersed with alkali soils and salt-grass. The bottom land of the Tuolumne river is very sandy, while that of the Stanislaus is a dark and firm loam, bearing a luxuriant growth of grape-vines among the oaks. This bottom is about 300 yards wide. The plains are very level and without timber-growth, except narrow belts of cottonwood and oak along some of the large streams, whose bottom lands are generally quite narrow. The lands of the central part are sandy, especially south of the Tuolumne river, passing northward as well as westward into gray or blackish loams, from which there is a gradual transition to the heavier adobe soils of the immediate valley of the San Joaquin river, into which the plains fall off with a gentle slope and change to a brown sandy loam, sometimes with a deep orange-red subsoil, as they approach the foot-hills of the east. Oakdale is situated about 80 feet above the bed of Stanislaus river in the northeastern part of the county, and in a region of black lands which extend southward half way to Lagrange. The lands are not uniform in character, but are interspersed with tracts of red soils, and the depressions often contain cobble-stones. The last half of this foot-hill border region is undulating, and the soils are more generally a reddish loam.

The foot-hills of the Sierra extend but a few miles into this county, forming a narrow belt along the east, the soil of which is mostly a red clay, except on the north of Stanislaus river, or in the northeastern part of the county, where the lands are dark loams, with some adobe. An inferior pine growth is found in some places. The foot-hills of the Coast range on the west are rolling and broken and have a width of several miles. The soil is mostly sandy, and is under cultivation to some extent in the valleys.

The mountains of the Coast range rise to an elevation of over 2,000 feet, and are rough and much broken.

The crops of the county are chiefly wheat, barley, oats, and corn; the fruits comprise oranges, lemons, limes, pomegranates, olives, peaches, apples, pears, and almonds. Grapes and peanuts are also raised. The average yield of wheat is 15 bushels per acre when winter-sown.

The county is not thickly settled, the average being but 6.1 persons per square mile. More than 45 per cent. of its lands are, however, under cultivation, the average being 294 acres per square mile, thus placing the county seventh in the state in rank as a farming region. It claims to be the banner county for wheat production. The Southern Pacific railroad passes through the central part of the county from northwest to southeast, and affords transportation to San Francisco and Sacramento or to the Atlantic states.

ABSTRACT FROM THE NOTES OF N. J. WILLSON, OF THE SOUTHERN PACIFIC RAILROAD.

The country around Salida station, in the northern part of the county, is generally level, and has a sandy loam soil, which extends to within a few miles of Modesto before a change takes place. Hard-pan underlies the lands at from 30 inches to 5 and 10 feet. Water is obtained in wells at from 18 to 50 feet. The elevation of this station is 75 feet above sea-level. The natural vegetation of the region is clover, alfilerilla, and some bunch-grass; there is no natural timber nearer than Stanislaus river. The average yield of the soil is from 15 to 18 bushels of wheat per acre, and, when summer-fallowed, from 25 to 33 bushels.

Hog-wallow lands appear within a few miles of Modesto station, which has an elevation of 90 feet. The country is underlaid by hard-pan at from 30 inches to 5 feet, and water is obtained in wells at from 75 to 110 feet. There is no natural timber nearer than the Tuolumne river, on the south, on whose banks there is much willow, some oak, and ash. The vegetation embraces clover, alfilerilla, bunch-grass, and wild oats. Wheat is the chief crop of this section, and yields, with summer-fallowing, from 30 to 60 bushels per acre. Around Ceres (95 feet elevation) the lands are generally level, with some hog-wallows on the south. The soil is a sandy loam, which continues southward to Turlock and the county-line.

MERCED.

Population: 5,656.

Area: 2,280 square miles.—San Joaquin valley, 1,740 square miles (including adobe, 320 square miles); lower foot-hills, 20 square miles; Coast Range mountains, 520 square miles.

Tilled lands: 277,689 acres.—Area planted in wheat, 67,975 acres; in corn, 574 acres; in oats, 25 acres; in barley, 10,181 acres; in vineyards, 178 acres.

Merced county, with its eastern border lying along the edge of the foot-hills and its western on the Coast range of mountains, is divided into two parts by the San Joaquin river, which flows nearly centrally through it in a northwest course, and to which the surface of the country slopes from either side. The chief stream of the county (besides the San Joaquin) is the Merced river, which, rising among the high Sierra, flows through Yosemite valley and the foot-hills of Mariposa county, and westward across the plains of this county, in a valley bordered by high banks for the greater part of the distance, to the San Joaquin river. Dry creek is one of its few tributaries. Bear creek, on which the county-seat is located, rises among the foot-hills of Mariposa county, and in its western course across the valley flows between high banks for a large part of the distance. On the south of this stream are Mariposa and Chowchilla rivers, the latter forming the southern boundary-line. Besides these there are numerous creeks and sloughs, all flowing westward and disappearing in the plains before reaching the San Joaquin river. Similarly, in the western part of the county, there are numerous creeks tributary directly to the San Joaquin that have their source in the Coast range, but are of no special importance, only reaching the river in time of flood. The San Joaquin river, in its course through this county, is bordered by a belt of tule lands reaching from the southern boundary northward nearly to the mouth of Merced river, and having a width of several miles, though lying almost entirely on the west side of the river. The surface of the entire county (except along the large streams, which are bordered by a growth of oak), is treeless, and presents great variety in its agricultural features. Immediately eastward of the San Joaquin river there is a region of drifting white sand reaching from the Stanislaus county line on the north southward nearly to Bear creek, and eastward beyond the railroad to the point where Dry creek unites with Merced river, while still eastward along the river the soil changes to a sandy loam more or less gravelly. The lands of the sand region are level or rather rolling, the soil usually very deep, and has a vegetation of alfilerilla, some clover and tar-weed, and occasionally some rattle-weed. Wheat is chiefly cultivated, the yield being from 10 to 15 bushels per acre in ordinary seasons.

The lands of Bear river, from the foot-hills to its mouth, are chocolate-colored clays, more or less adobe in character, while southward to Mariposa river black adobe and hog-wallow lands prevail and contain some alkali in that portion of the region partly covered with sand, which extends from the railroad westward to San Joaquin river. This region is a level plain to the very foot-hills. South of Mariposa river the lands of what is known as the Chowchilla region, embracing that creek and the sloughs that are connected with it, are sandy, and, in places, of such a character as to be called "sand mush"; they are also largely alkali and hog-wallow in character, especially around Plainsburg and westward, where they are best suited to pasturage. Clover and alfilerilla (except on the alkali soils, where the salt-grass occurs) comprise the vegetation.

In the northeastern part of the county, and east of the sand region first mentioned, the country is rolling and partly hilly, the Black Rascal hills being embraced in a belt of black adobe, hog-wallow, and gravelly lands reaching from Stanislaus county a little southeastward to Mariposa river, south of Bear creek, its continuity broken by the sandy border lands of the two rivers; its width east and west is from 1 to 2½ miles. The hills are from 100 to 200 feet in height, and are capped with about 25 feet of red gravelly clays, while on their sides and in the valley are the adobe lands, in whose swales, as well as in the creeks, there are cobble-stones. This belt passes about 6 miles northeast of Merced, the county-seat. To the eastward of the belt, and south of Merced river, the valley lands are red and gravelly to the foot hills. (*a*)

The Merced River valley, which at Hopeton is about 4 miles wide, is bordered on the south by a line of hills some 50 or 60 feet above it, which extend westward, gradually falling in elevation, nearly to the railroad at Cressy. The adobe lands mentioned occupy the landward slope of these hills, and are found to be underlaid by a whitish, fissured clay-stone, sandy and ferruginous, easily cut, and used for building low walls. The lands of this river valley are a sandy loam, interspersed with underground gravel ridges, which in many places spoil the lands for farming purposes. The soil of Dry creek is light and reddish, very deep, and yields 25 or 30 bushels of wheat per acre. The uplands north of Merced river are sandy and in part more gravelly than on the south, and will yield from 20 to 25 bushels of wheat per acre. Merced Falls is at the border of the foot-hills region, and here, as well as northward, are found partly metamorphosed slates standing almost vertically on edge. The foot-hills are sparsely covered with an oak growth, and their soils are chiefly red, gravelly, rocky, and rather stiff.

The crops of the county are chiefly wheat and other small grain. Cotton is planted in the Merced River valley quite extensively, and grows from 3 to 4 feet high, yielding an average of 1,200 pounds of seed-cotton per acre, 100 pounds of which make 30 pounds of lint. The crop is irrigated once, usually in June; a later time would cause much new growth, while another irrigation causes the plant to run too much to weed.

The Robla canal, carrying water from Bear creek, is 12 miles long, and is said to have a capacity of 120 cubic feet per second. The Farmers' canal takes water from Merced river 3 miles below Merced Falls; thence its route lies along a rolling side-hill, through a tunnel 4,000 feet long, a distance of 6 miles to Canal creek. The bed of this creek carries the water for 13 miles further, and thence it is distributed principally on the plains between the river and town of Merced.

The lands of the county are largely under cultivation, the general average being 121.7 acres per square mile, the county ranking thirteenth in the state in this regard.

The Southern Pacific railroad passes through the valley region of this county from north to south.

ABSTRACT FROM NOTES BY N. J. WILLSON, OF THE SOUTHERN PACIFIC RAILROAD.

The lands around Cressy and Atwater stations are slightly rolling in places, though generally level. The soil is sandy, from 2 to 3 feet deep, and is underlaid by clay and sand. The natural vegetation is alfilerilla, some clover and tar-weed, and no natural timber growth. Wheat is the chief culture, and its yield is estimated at from 12 to 15 bushels per acre. There is a Dalmatian insect powder plantation

a Much of the above information was obtained from Mr. Kelsey, of Merced.

east of Atwater. The lands of this region can be irrigated by ditches from the canal that has been constructed through Cressy from Merced river, some 20 miles distant. At Merced, altitude 170 feet, the soils are a dark loam from 2 to 6 feet deep, overlying a hard-pan. The vegetation is alfilerilla, clover, and salt-grass, with some rattleweed 10 or 12 miles distant. The banks of Bear creek are from 50 to 100 feet apart and 15 feet in depth, but they seldom overflow. Western trade winds bring in some fog. This kind of land extends northwest for some 3 miles and southeast the same distance. The lands at Plainsburg station (205 feet), reaching one and a half miles north and south for some distance, are sandy and hog-wallow, and are impregnated with alkali to a considerable extent; they are underlaid at from 1 to 30 feet by a hard-pan. Wheat and barley are the chief crops, the yield of the former being about 17 bushels per acre.

FRESNO.

Population: 9,478.

Area: 8,000 square miles.—San Joaquin valley, 3,520 square miles (including tule land, 250 square miles); lower foot-hills, 500 square miles; higher foot-hills and mountains, 3,060 square miles; Coast range, 920 square miles.

Tilled lands: 291,087 acres.—Area planted in wheat, 20,474 acres; in corn, 414 acres; in oats, 9 acres; in barley, 9,504 acres; in vineyards, 471 acres.

Fresno, one of the three large counties that embrace the upper portion of the San Joaquin plains, reaches from the Sierra mountains westward across the plains to the summit of the Coast range, the elevations on each side being, respectively, above 10,000 feet on the east and about 3,000 feet on the west above the plains. The plains extend westward to the foot of the mountains on the extreme border of the county, and are separated from the Sierra on the east by a broad region of foot-hills.

The lowest portion of the county is in the central part of the plains from southeast to northwest, and embraces a belt of tule lands, marshes and sloughs extending from the border of Tulare county, on the southeast, to the point where the San Joaquin river makes its northwestward bend and thence becomes the central feature of the valley. This river is the largest stream in the county. It rises among the mountains and foot-hills of the east and flows in a westward course to the middle of the plains, thence turns northwestward toward the Sacramento valley, and has along its immediate border a timber growth of cottonwood, sycamore, willow, and large oaks.

King's river, emerging from the cañons about 40 miles eastward from Fresno, flows in an irregular course southwestward and traverses a region of undulating plains, until to the northward of Tulare lake it enters the Mussel Slough region, described under the head of Tulare county. Ordinarily the waters of King's river not diverted by the numerous irrigation ditches enter Tulare lake, but in time of high water they pass partially through Fresno slough into the San Joaquin river. A number of creeks, rising among the foot-hills on either side of the valley, flow out upon the plains, but disappear before reaching the river. Numerous sloughs also occur.

The eastern part of the county is extremely rugged, the western face of the Sierra Nevada mountains, as well as the higher foot-hills, being cut by tremendous chasms, through which flow King's, Fresno, and San Joaquin rivers and their tributaries. Some of the highest peaks rise to an altitude of more than 14,000 feet. An abundance of timber is found on the western slope of this mountain region, two large bodies of redwood being reported on the northeast and southeast. At the head of Fresno river there is a heavy growth of sugar and yellow pines, fir, Big Trees, and white cedar, with white ash in other places. The mountains of the west are partially timbered with oak and scrub pine.

The foot-hills are rolling and broken in a belt 20 or 30 miles in width, covered with scattered oaks, and are interspersed with high and prominent peaks and ridges. The narrow valleys of the streams alone are suitable for cultivation. The plains possess a variety of lands. The greater portion, however, is a sandy loam, with no timber growth, and requires irrigation to be productive. On the western side of the river the plain slopes gradually from the Coast range to the slough, and much of its land, even with irrigation, is said to be too poor and sandy for farming purposes. Along Fresno slough, for several miles in extent, there is much alkali land. Much of the valley land is of an ashencharacter in color. The plains, with a whitish calcareous loam soil (such as that of Central and Washington colonies, of which an analysis is given on page 28), extend eastward from the river to the railroad, beyond which the surface of the country rises a few feet to a slightly undulating plateau reaching to the foot-hills. This plateau is destitute of trees, and is traversed by low, sandy ridges, which lie between the creeks and from 15 to 20 feet above the level tracts adjoining the streams, or what may properly be called the general level of the plateau. These level lands have a brownish or reddish sandy loam soil, produced by the more or less admixture of the red foot-hill clays, and nearer the streams it is stiff enough to be locally designated as adobe. The ridges in the vicinity of King's river contain much white quartz gravel. The plateau region reaches from the San Joaquin river, near the railroad crossing, southward to 1 mile southwest of Fresno, and thence east to King's river.

On the west of the San Joaquin river the plains reach 20 miles to the foot-hills of the Coast range, which form a belt, about 10 miles wide, "of low hills, covered only with grass; thence to the summit the hills are more abrupt, covered with scrubby oak, and in many places with a dense growth of chaparral."

There are a number of colonies located within from 2 to 6 miles of Fresno city, and all of them are engaged in agricultural pursuits, and have their schools, churches, and social and literary societies. The county is sparsely settled, the average being but a little more than one person per square mile, while the lands under cultivation average 36.3 acres per square mile. The crops of the county embrace chiefly wheat, barley, corn, oats, potatoes, and alfalfa; but there are numerous orchards and vineyards in successful cultivation. Cotton has been grown with an excellent yield, but the cost of production and the small demand makes it rather unprofitable. The Southern Pacific railroad passes through the county from San Francisco on the north to the Atlantic states on the southeast.

From the great bend of the San Joaquin river two canals have been constructed, the Chowchilla and the San Joaquin and King's River. The Chowchilla canal has a length of about 30 miles, and lies on the east of the river, crossing in its course northward Cottonwood and Bereoda sloughs and the Fresno, Mariposa, and Chowchilla creeks. Its capacity may be taken at from 200 to 250 cubic feet per second. The San Joaquin and King's River canal, lying on the west side of the river, reaches to Orostimba creek, a distance of 67 miles, being longer than that of any other irrigating canal in the state. It commands an area of about 283,000 acres, which includes all the lands lying between it and the river, 130,000 acres of which are low, and naturally subject to overflow in seasons of ordinary flood. Its capacity is about 600 cubic feet per second.

Another small canal from the Fresno river on the south side is used upon land within 9 miles of the head-gates. Don Palos and Temple sloughs have also been converted into canals by deepening and enlarging their channels.

In the southern part of this county there are a number of canals and ditches taking water from Fresno river. The King's River and Fresno canal, from near the foot-hills, has a length of 22 miles, and supplies water to the scattered farms on the high plains north and east of the town of Fresno.

The Fresno Canal and the Irrigation Company's canal takes water a mile below the head of the last canal, and conducts it to the immediate neighborhood of the town of Fresno. Its total length, with branches, is 63 miles. The Centreville and Kingsburg canal, 26 miles long, conducts water to Kingsburg. Besides these there are several other smaller ditches and canals reaching to different parts of this county.

ABSTRACT FROM THE NOTES OF N. J. WILLSON, OF THE SOUTHERN PACIFIC RAILROAD.

The country around Minturn station (elevation 240 feet) is rather rolling, with compact sandy loam, hog-wallow soils, apparently "alkali" in character. Near Chowchilla creek there are a few scattering oak and cottonwood trees, but otherwise the vegetation embraces chiefly clover, alfilerilla, salt-grass, etc. Thence to Berendo and Madera stations the sandy loam hog-wallow lands continue from 1 to 4 feet deep, containing more or less alkali, and underlaid by hard-pan at from 22 to 48 inches. There is no natural timber growth, and the lands are chiefly devoted to pasturage. Water for ordinary purposes is obtained from wells at a depth of from 18 to 20 feet, while for irrigating purposes it is brought by the Fresno canal to Madera station, where wheat is raised and grape-vines have been planted quite extensively. At Borden station (elevation 310 feet) the country is level, and has a coarse, sandy soil, some 10 feet deep to hard-pan. There is here no natural timber, and the vegetation embraces alfilerilla and clover. Wheat is the chief crop, and yields about 20 bushels per acre. Water for irrigation purposes is brought by the Fresno canal. On the south of the San Joaquin river the hog-wallow lands again appear, the soil being a reddish loam, with a deeper-colored subsoil at 12 inches. Alfilerilla predominates, though there is considerable pepper-grass. Sheep-raising is the chief pursuit. Around Fresno (elevation 290 feet) the country is generally level, with some hog-wallow places; the soil is a dark sandy loam, with no timber growth. The crops comprise wheat, barley, and alfalfa, the yield being about 25 bushels of the former per acre. Vineyards are being cultivated extensively, but entirely with irrigation, the water coming from King's river. There are five colonies in the vicinity of Fresno: Washington colony, located some 4 miles west, containing 5 sections, or 3,200 acres; Central colony, 2½ miles west, containing 6 sections; Church or Temperance colony, 4 miles northeast, containing 2 sections; the Scandinavian colony, 3 miles north, containing 3 sections; and the Nevada colony, 4 miles northeast, containing 3 sections. All of the above are divided into 20-acre lots, and the lands are subject to irrigation, the chief crops being grapes, fruits, and vegetables. Fowler station (elevation 310 feet) is situated in a level plain with white silty soils and without timber growth. Hard-pan is found in spots at all depths from the surface to 10 feet. There is comparatively little farming done in this section, or until near Kingsburg, toward which place the country becomes more rolling, the soil also changing to a gray sandy loam, some 4 feet in depth. The only timber growth is on King's river, and embraces oak, willow, cottonwood, sycamore, ash, and elder.

TULARE.

Population: 11,281.

Area: 5,610 square miles.—San Joaquin valley, 1,775 square miles (tules, 30 square miles); lower foot-hills, 390 square miles; higher foot-hills and Sierra mountains, 3,245 square miles; Coast range mountains, 200 square miles.

Tilled lands: 200,650 acres.—Area planted in wheat, 28,131 acres; in corn, 2,535 acres; in oats, 6 acres; in barley, 3,661 acres; in vineyards, 309 acres.

Tulare county, in common with the other two great counties of the San Joaquin valley, embraces within its area high Sierra mountains on the east which are 10,000 feet or more above the sea, a small region of low Coast Range mountains on the west, and a broad and low valley and foot-hills region between the two mountain ranges. A prominent feature of the county is Tulare lake, a large body of water, 33 miles long and 22 miles wide, lying on the western side of the valley, and having a somewhat alkaline water. This lake receives the drainage waters from the entire county, though many of the streams break up into sloughs and reach it through numerous channels. The chief of these streams are White, Tule, Kaweah, and King's rivers. The creeks and sloughs are many in number, and lie almost exclusively on the east.

All the streams named, heading in the Sierra, flow through deep and precipitous cañons until they reach the plains, when they meander through their broad and fertile bottoms, some of them separating into several channels, forming wooded islands. The Kaweah is thus divided up into eight or ten branches, though when first discovered, under the supposition that there were only four of these channels, the name of "Four creeks" was given to them collectively, a designation which they have ever since retained, though each has now an individual name of its own.

Most of these bottoms, as well as portions of the plains lying between them, are covered with scattered oak trees (sometimes dense forest) of large size, which, though they are not worth much for lumber, are serviceable for fencing, and supply an abundance of good fuel. All that part of the county lying west and southwest of the lake is destitute of timber, though the entire slope of the Sierra Nevada is covered with majestic forests of coniferous trees, even to its very summit.

About 46 miles northeast of Visalia, and at an elevation of between 6,000 and 7,000 feet, occur great numbers of Big Trees, not standing in groups and isolated groves as in Calaveras and Mariposa counties, but scattered throughout the forests all the way from King's river to the Kaweah, a distance of over 40 miles, and perhaps much further.—*Natural Wealth of California.*

The *mountainous region* covers more than one-third of the county area, and some of the peaks are the highest in the state, Mount Whitney being the highest on the Pacific coast (15,000 feet). The foot-hill region lying at the foot of the Sierra has a width varying from 9 to 12 miles. The surface is much broken with high and isolated hills and ridges, interspersed with many small valleys, which furnish the only lands suitable for farming purposes. Their soil is red, clayey, and gravelly. The lands of the *valley* are quite level and mostly destitute of trees. Visalia, the county-seat, is situated in the Kaweah delta, a region of oaks, which extends half way to Goshen on the west, 15 or 20 miles southwestward, and several miles northeastward. The soils of the valley vary from a light sandy loam to a light adobe; and a large tract of highly productive, dark alluvial loam occurs in the Mussel Slough region, north of the lake, and reaches eastward from within one mile of King's river to Cross creek, 6 miles from the Southern Pacific railroad. Tule lands, sometimes of large extent, occur on the borders of the lake and along the various streams and sloughs. The lands of the county are too dry to be successfully cultivated without irrigation, and

ditches have been dug many miles long from the larger streams to furnish the necessary water. The chief crops are wheat, barley, corn, potatoes, and hay, but fruits, comprising apples, pears, peaches, and grapes, are also raised. Lemons and oranges are grown in the foot-hills. Cotton also has been successfully produced in the county, the Matagorda variety doing best; and there seems to be little doubt that, with a demand for the staple and the erection of gins and mills, the crop would be made profitable.

Water has been obtained in artesian wells near Tulare at a depth of 295 feet, the flow being about 100,000 gallons in twenty-four hours and having a temperature of 70° F. Another well, at a depth of 330 feet, furnished nearly double that amount of water, and many more of similar yield have lately been obtained. This county is more thickly settled than Fresno, the average being two persons per square mile for the county at large. The lands under cultivation have an average of 35.7 acres per square mile, and are chiefly planted in wheat, barley, alfalfa, etc., the chief areas of production being the country around Visalia and the Mussel Slough country.

The Southern Pacific railroad passes through the central part of the county, connecting with San Francisco on the north and with the Atlantic states on the southeast. A branch road extends westward from Visalia, and to the Mussel Slough region on King's river.

From King's river there are six canals that take water below the crossing of the railroad and conduct it to the Mussel Slough country, their total length with main branches being 116 miles. There are also a number of small farm ditches in the same region taking water in the channels north. The region covered is about 155,000 acres.

ABSTRACT FROM A DESCRIPTION BY F. G. JEFFERDS, OF FARMERSVILLE.

The surface of this portion of Tulare county is generally level, the fall from the foot-hills to Tulare lake, a distance of about 30 miles, being 8 feet per mile. The streams do not run in deep channels, but frequently change their channels; and in flood years the old ones fill up with sand from the mountains. Water for irrigation in this region is taken from the Kaweah river, while for drinking purposes it is obtained from bored wells, at a depth of from 30 to 60 feet. Surface water is found in abundance at from 12 to 18 feet, but we prefer that from the gravel beds at from 30 to 60 feet. Our best lands yield 25 or 30 bushels of wheat or from 30 to 40 of barley per acre; alfalfa needs irrigation twice a year to do well.

Frosts seldom appear before December. Storms come from the southeast, showers from the northwest, and dry winds from the north. In dry seasons the winds follow the sun, coming from the east in the morning, from the south until about eleven o'clock, when it changes to the northwest, and in the evening to the north. Fog never appears, except in rainy seasons.

ABSTRACT FROM THE NOTES OF N. J. WILLSON, OF THE SOUTHERN PACIFIC RAILROAD.

The lands lying between King's river and Cross Creek station on the north are mostly light sandy loams with hog-wallow surface, while southward to Goshen they become more silty, with some hog-wallows, and throughout are more or less interspersed with alkali tracts. The natural vegetation is alfilerilla, salt-grass, and alkali weed. The elevation of the country is 275 feet above the sea, and its surface is without any timber growth. There is no farming done within the alkali belt, which extends several miles on either side of the railroad. Wells are from 40 to 80 feet deep, the water at 12 feet being strongly alkaline and unfit for use. The country westward from Goshen to Hanford is quite level, but has some hog-wallows for six miles, and then for a mile is cut up with sloughs, the lands thus far being covered with a fine growth of alfilerilla, spotted with salt-grass. The rest of the country to Hanford embraces better lands, and is generally under cultivation, its elevation being about 250 feet. To Lemoore (elevation 225 feet) the lands are sandy, with some alkali spots, and have no timber nearer than King's river, on whose banks are found oak, sycamore, and willow. Besides the alfilerilla and salt-grass, there is some wire-grass and wild sunflowers. Wheat, barley, and alfalfa are the chief crops of this region, the yield being from 20 to 30 bushels per acre. Water for irrigation purposes is taken from King's river. From Heinlin to the river there is scarcely anything growing other than salt-grass and an occasional willow tree, while beyond the river sage-brush predominates.

From Goshen south to Tulare station the level country has a sandy soil, with spots of alkali, and is partly timbered with a natural growth of large oaks, which cover an area of 75 or 80 miles, the average being some three or four trees per acre. The soil is about 20 feet deep, but southward to Tipton station (elevation 265 feet) the underlying hard-pan comes to within 4 feet of the surface, often cropping out in the soil. Most of the lands around Tipton are silty and ash-colored and are impregnated with alkali, especially in the immediate vicinity, where the vegetation is principally salt-grass. To Alila station (elevation 275 feet) the country continues perfectly level, and, with the exception of three miles of alkali belts, the whole surface as far as the eye can reach is covered with a luxuriant growth of grass, principally of alfilerilla and clover, with a considerable amount of rattle or loco and milkweed. The soil is sandy, and is not under cultivation.

From Goshen to this point the farms lie several miles from the railroad. Wheat and barley are the chief crops, the former yielding from 20 to 30 bushels per acre in good seasons. There is an artesian well, 423 feet deep, 1¼ miles from Tipton station, which flows 97,000 gallons in twenty-four hours, but in ordinary wells water is obtained at from 20 to 50 and 80 feet.

KERN.

Population: 5,601.

Area: 8,160 square miles.—San Joaquin valley, 2,590 square miles (tules, 290 square miles); lower foot-hills, 560 square miles; higher foot-hills and mountains, 1,955 square miles; desert lands, 2,180 square miles; Coast Range mountains, 875 square miles.

Tilled lands: 61,497 acres.—Area planted in wheat, 6,887 acres; in corn, 1,694 acres; in oats, 80 acres; in barley, 6,151 acres; in vineyards, 68 acres.

Kern is one of the largest counties of the state, and includes within its boundaries the extreme upper (southern) end of the San Joaquin valley, as well as parts of the Sierra mountains and Mojave desert on the southeast and south, and of the Coast range of mountains on the southwest. The two mountain chains unite on the south, and thus form a high border of from 2,000 to 4,000 feet above the valley on all sides except the north, their spurs often extending far into the plains. The lower ranges and hills on the east and south are generally covered with grasses and shrubbery, and often with oak, pine, and fir trees. The mountain region of the west is said to be valueless for farms; that of the south and east, on the contrary, has numerous high valleys, which are largely under fence and to some extent in successful cultivation. The Tehachapi valley, through which the Southern Pacific railroad passes, is about 12 miles long and 3 miles wide, surrounded by very high mountains, and in it there is a small salt lake. In this valley the *Yucca* first appears, which afterward becomes so predominant in the Mojave desert.

Cumming's valley, with a length of 6 and a width of 3 miles, and Bear valley, 3 miles long and 1 mile wide, nearly adjoin Tehachapi. Abundant timber is said to be easily accessible to all of the mountain valleys. The valley of the south fork of Kern river, 8 miles north of Havilah, contains about 40 square miles, and is well timbered. The surface of the plains is very level and treeless, and for the most part has a sandy-loam soil, which, with proper irrigation, is quite productive. From Bakersfield eastward for 10 miles to the foot-hills and cañons of Kern river there is a strip of undulating country elevated above the valley proper and having a sandy-loam soil. From Bakersfield southward a belt of tule marshes reaches to Kern and Buena Vista lakes (themselves now little else than marshes, connected by a slough 100 feet wide), and thence northward to Tulare lake, forming the outlet, in part, for the waters of Kern river. The lakes are gradually disappearing by evaporation, because of the shutting off of their supply by irrigating canals. The waters are strongly charged with alkali, and are totally unfit for use.

Kern River slough reaches from the north of Bakersfield westward toward the marshes and forms, as it were, a "cut-off", the country thus included between it and the old channel and the marshes of the east, south, and west being a delta region of rich sandy loams, originally having a willow and cottonwood growth, and embracing the chief farming lands of the county, known as "Kern island". Previous to 1875 this delta region, with the rest of the county, was considered almost worthless agriculturally, and was almost entirely uncultivated; but by means of an extensive system of irrigating canals Messrs. Haggin, Carr, and Livermore have shown that the lands are highly productive, and large ranches of thousands of acres each are now under cultivation on this island. Irrigation is, however, absolutely necessary, and a network of ditches and canals from 2 to 20 miles or more long and from 20 to 150 feet wide has been constructed, bringing the waters of Kern river into every portion of the county and carrying cultivation far into the plains. The following summary of irrigating canals is taken from the state engineer's report:

District No. 1, between old South Fork and Old river. Total area, 80,000 acres; number of canals, 5; aggregate capacity of canals, 895 cubic feet per second.

District No. 2, west of Old river, and south of New river. Total area, 64,000 acres; number of canals, 9; aggregate capacity, 348 cubic feet per second.

District No. 3, between New river and Goose Lake slough. Area, 70,000 acres; number of canals, 11; aggregate capacity, 1,924 cubic feet per second.

District No. 4, swamp lands south of Tulare lake. Area, 103,000 acres; number of canals, 2; aggregate capacity at head, 3,370 cubic feet per second.

District No. 5, north of Kern river and Goose Lake slough. Area, 360,000 acres; number of canals, 6; aggregate capacity, 645 cubic feet per second.

Total number of canals and ditches, large and small, 33; total length of main canals and branches, 275 miles. From the Kaweah river there are 16 canals; two carry water to the Mussel Slough region, the others to the region of Visalia.

Many artesian wells have been successfully bored on the north side of the two lakes, water being obtained at depths of from 200 to 300 feet. The artesian belt, as developed by the wells, has a length of about 18 miles and a width of 6 miles.

The principal ranches are the Livermore, about 12 miles south of Bakersfield, and the Belleview ranch, about 18 miles southwest, along Kern and Buena Vista lakes, each including about 7,000 acres, and nearly all under cultivation. "From Fort Tejon, on the southern extremity of the county, to Kern river, a distance of about 40 miles, along the western border, the county for 10 miles from the Coast range of mountains is covered with salt marshes and brine and petroleum springs."

The county is sparsely settled, the average being much less than one person (six-tenths) per square mile, while the average of lands under cultivation is 7.5 acres per square mile. The crops embrace wheat, barley, corn, etc. Cotton also has been successfully raised, but the want of a market has made its production less remunerative than other crops.

Transportation facilities are afforded by the Southern Pacific railroad, which passes through the county, connecting with San Francisco on the north and the Atlantic states on the southeast.

ABSTRACT FROM THE NOTES OF N. J. WILLSON, OF THE SOUTHERN PACIFIC RAILROAD.

The surface of the country from the northern county-line along the railroad to Pozo station (415 feet above the sea) is perfectly level with the exception of 3 miles of hog-wallow land. The soil is sandy, covered with alfilerilla, clover, and pepper grass, and underlaid with hard-pan at from 6 inches to 3 feet. The country is entirely devoted to pasturage, and no farms are found nearer than that of Haggin & Carr, 3 miles west of Pozo. From Pozo southward to within a couple of miles of Pampa station the country is very level, covered with a fine growth of alfilerilla, with some sage-brush, and is well adapted to pasturage for sheep. The surface rises to an elevation of 870 feet, and is without timber growth. The soil is sandy, though silty at Lerdo station, and there is no farming being done nearer than Bakersfield. In the immediate vicinity of Bakersfield the soil is quite sandy, which with a stiff wind drifts considerably, and it is estimated that 5 per cent. of the lands of this region are so strongly alkali in character as to be utterly worthless. They have only a salt-grass vegetation. Some of the land which a few years ago was apparently free from alkali is now impregnated to a considerable extent, and in some instances land that produced large crops of wheat three or four years ago will scarcely grow salt-grass now. On Kern river there is a natural timber growth of willow, cottonwood, elder, and a few sycamores. The chief crops are wheat, barley, alfalfa, corn, and potatoes; wheat yields from 20 to 40 bushels per acre, and alfalfa from 7 to 10 tons, being cut four or five times during the year. The yield of corn varies from 40 to 75 bushels. Tree-planting, embracing many varieties, has been tried quite extensively and with success where the trees had water, the only trouble being from gophers and frost. Grape-vines and fruit trees of all kinds do well with water. Good water is obtained in wells at 40 or 50 feet, but that nearer the surface contains alkali. Frost usually appears during November, and sand-storms sometimes cause considerable damage by uprooting grain unless this is firmly rooted before the winds occur.

Toward Pampa station the plains become narrow, and are lined on the east by rolling lands. The station itself (elevation 870 feet) is situated in a valley about half a mile wide, with high rolling hills running back to the mountains on either side. The soil is gravelly and full of cobble-stones, and is made up of the washings of Agua Caliente and Walker Basin creeks, the waters of which do not reach his far, but sink within a mile or so. During wet winters water has been known to stand more than a foot in depth all over this valley. The vegetation is chiefly alfilerilla, of which there is a fair growth, both in the valley and on the hills. There is also considerable sage-brush and some cottonwood trees. No farming is done except on Walker's creek, where a few acres of hay and also a few fruit trees are raised.

From Pampa to Caliente station there is a deep and narrow cañon, in which runs the Agua Caliente creek. The bottom of the cañon is little else than washed sand and gravel, cobble-stones and bowlders, but on the hills the soil is from 6 inches to 4 feet deep, and is underlaid with decomposed granite. On the hills there is a fine growth of alfilerilla, with scattering oak trees, while in the cañon there is some sage-brush, with willow, cottonwood, and sycamore trees. Milk- and rattle-weeds are plentiful.

From Caliente through the mountains to the desert region the railroad passes through grassy cañons, in part having but little timber growth, except on the hills. The soil is usually sandy and gravelly, and scarcely under cultivation. Beyond Tehachapi summit the soils of the cañons are sandy and dry and partly alkaline.

From the edge of the desert to Mojave station (elevation 2,700 feet) there is little else than sage-brush and creosote weeds, also some achoia or chollu. The soil is reddish and sandy, and not at all under cultivation. Water is brought from Cameron station by pipes. The prevailing wind is from the northwest, and blows a perfect gale almost continually. Thence across the desert, to Lancaster, the only vegetation is Yucca tree, sage-brush, and creosote weeds. There is a great deal of alkali land, with salt-grass and weeds.

LOWER FOOT-HILLS REGION.

(Of the Sierra Nevada mountains and the northern Coast range.)

(This embraces the following counties and parts of counties: Of the Coast Range foot-hill counties—Shasta, Tehama, Yolo,* and Colusa*; of the Sierra foot-hill counties—Shasta, Tehama,* Plumas,* Butte,* Sierra,* Yuba,* Nevada, Placer, El Dorado, a little of Sacramento,* Amador, a little of San Joaquin,* Calaveras, Tuolumne, a little of Stanislaus,* and Merced,* Mariposa, Fresno,* Tulare,* and Kern.*)

SHASTA.

Population: 9,492.

Area: 4,000 square miles.—Lower foot-hills, 1,525 square miles; higher foot-hills and Sierra mountains, 1,950 square miles; Coast Range mountains, 525 square miles.

Tilled lands: 55,915 acres.—Area planted in wheat, 6, 267 acres; in corn, 59 acres; in oats, 677 acres; in barley, 6,762 acres; in vineyards, 113 acres.

Shasta county, situated at the head of the great valley drained by the Sacramento river, is one of the best-watered counties of the state. The river has very many confluents, both from the mountains of the Sierra on the east and north and from the Coast range on the west, all uniting near the southern border. Chief among these is Pitt river, whose source is in the northeastern corner of the state.

The mountains that cover a large portion of the county on all sides but the south are rugged and lofty, rising more than 5,000 feet above the sea. On the east there are four peaks of special prominence that stretch far into the county from the Sierras, separated from each other by distances of 10 or 12 miles, Lassen's peak, the highest of these, having an altitude of 10,577 feet, and timbered for two-thirds of the way up, the rest being bald, and usually covered with snow. Other peaks and buttes occur everywhere, and all are of volcanic origin, as shown by extinct craters, cones, sulphur deposits, beds of lava, etc. Hot and boiling springs are also of frequent occurrence. The mountains of the north and west parts of the county are covered with forests of conifers of nearly every variety, except redwood, while on the lower hills live-oak is abundant, and ash occurs along the streams.

The southwestern portion of the county, embracing about one-third of its area, is a foot-hill region having an altitude of not more than 2,000 feet above the sea. Its surface is hilly and broken, and is interspersed with numerous valleys along the several streams.

The tillable lands are chiefly east of the Sacramento river; a broad region, comparatively level, lies between that stream and Stillwater and Cow creeks, a distance of about 12 miles. The river itself from Redding south to the county-line is bordered by a strip of good farming land, dotted over with white oaks, and having but little undergrowth. The soil of these valleys is a reddish sandy loam, more or less gravelly; but near the creeks it is more clayey. The soil of the hills in places is adobe in character, but for the most part it is red and gravelly. Immediately north of Redding are found clumps of manzanita and large oaks.

Very little farming is done in this county, the chief industry being stock-raising. The average of cultivated lands is 13.9 acres per square mile.

Redding, the county-seat, is connected with Sacramento by the Oregon division of the Central Pacific railroad.

TEHAMA.

Population: 9,301.

Area: 3,060 square miles.—Sacramento valley, 265 square miles; lower foot-hills, 2,000 square miles; higher foot-hills and Sierra mountains, 420 square miles; Coast Range mountains, 375 square miles.

Tilled lands: 270,441 acres.—Area planted in wheat, 84,254 acres; in corn, 24 acres; in oats, 298 acres; in barley, 14,967 acres; in vineyards, 39 acres.

Tehama county is situated at the northern end of the great valley of the Sacramento river, and reaches from the Sierra on the east across this valley to the Coast range of mountains on the west, with an extreme width east and west of 86 miles and a length north and south of about 35 miles. The topography is greatly varied, the Sacramento river forming a central feature with its very level and open valley of from 7 to 15 miles width, bordered on the east, north, and west by a region of foot-hills, which extend back, with increasing altitudes, to the foot of the mountains. The valley, foot-hills, and mountains thus constitute three general divisions, and differ in their agricultural features.

"All the streams heading in the Sierra run in deep cañons, which open upon the Sacramento valley in gate like chasms, the lava formation through which they flow terminating here with an abrupt edge. Below this is a barren, treeless belt covered with volcanic fragments, which, gradually sloping te the west, merges in the fertile bottom lands along the river."—*Natural Wealth of California.*

The *Sacramento valley* is the most important of these divisions, comprising, as it does, the chief grain-producing part of the county. The valley proper has its head a short distance above Red Bluff, on the river, on both sides of which it extends southward in a belt of a few miles width through the county, widening out rapidly to the westward below the county-line. Along the immediate banks of the river there is a narrow strip of bottom loam, very rich and productive, whose original growth was cottonwood and sycamore; but the soil of the valley proper is a reddish loam with no timber, the surface presenting a broad and open prairie plain.

The *foot-hills* are rolling, treeless, and usually much broken, but they are interspersed with narrow valleys, watered by streams flowing into the Sacramento river. The hills are generally too rocky and barren for the culture of grain, but are thought to be suitable for grapes. The soil is chiefly a red gravelly and rocky loam or clay. Near the foot of the mountains stock-raising is almost the only pursuit.

The *mountains* are too high and barren for agricultural purposes. Those of the Sierra are generally timbered with spruce and pine and covered with snow for most of the year; those of the Coast range are lower in altitude, and have a growth of inferior pine and oak. Lumbering is the chief industry in the mountains.

Wheat is the chief crop of the county, though fruits, grapes, etc., are now receiving more attention. The lands of the county under cultivation average 88.3 acres per square mile, the average of population being but 3 persons per square mile.

The agricultural or valley region is supplied with transportation facilities by the California Pacific and Central Pacific railroads, which pass through, west and east of the river, via Willows and Sacramento, to San Francisco.

YOLO.

(See "Great valley region".)

COLUSA.

(See "Great valley region".)

PLUMAS.

(See "Sierra mountain and higher foot-hill region".)

BUTTE.

(See "Great valley region".)

SIERRA.

(See "Sierra mountain and higher foot-hill region".)

YUBA.

(See "Great valley region".)

NEVADA.

Population: 20,823.

Area: 990 square miles.—Lower foot-hills, 440 square miles; higher foot-hills and Sierra mountains, 550 square miles.

Tilled lands: 25,207 acres.—Area planted in wheat, 304 acres; in corn, 32 acres; in oats, 1,165 acres; in barley, 543 acres; in vineyards, 107 acres.

Nevada, a long and narrow county, extending from the state-line westward across the high Sierra and southwestward into the foot-hills, is watered chiefly by south and middle Yuba rivers and Elk creek on the north, while Bear river marks the southern boundary, all flowing west toward the Sacramento river. Several small lakes occur among the mountains of the east, the largest being Donner lake, 2 miles from Truckee. The greater part of the county on the east is rugged, wild, and uninhabited (the mountains in places rising more than 8,000 feet above the sea), and is almost exclusively devoted to mining operations. The western part, or less than half the county area, lies within the "foot-hill region", and embraces the lands suitable for farming purposes. Its extreme altitude is not over 2,000 feet. Near the mountains its surface is very broken and hilly, the low spurs of the Sierra reaching far westward and forming a region "diversified with deep ravines, knolls and dales, rolling prairies, wooded mountains, and gently sloping hills. It has a mixed growth of oak and pines, occurring in clumps, and an undergrowth of buckeye, chamizal, wild lilac, and manzanita". Lumbering is the chief industry among the forests of pine, spruce, fir, sugar pine, and cedar. The extreme western part of the county is less broken, and the lands more in cultivation. The soils of the uplands comprise red loams, more or less gravelly, or gray sandy granitic lands; those of the bottoms and flats are often dark alluvial loams.

The county averages 2.1 persons per square mile. The cultivated lands average 25.6 acres per square mile for the county at large, or about 5.7 acres for the foot-hill and valley region.

The Nevada Central railroad connects with the Central Pacific at Colfax, the latter road also traversing the eastern part of the county.

PLACER.

Population: 14,232.

Area: 1,480 square miles.—Sacramento valley, 220 square miles; lower foot-hills, 450 square miles; higher foot-hills and Sierra mountains, 810 square miles.

Tilled lands: 101,923 acres.—Area planted in wheat, 11,751 acres; in corn, 160 acres; in oats, 873 acres; in barley, 5,594 acres; in vineyards, 1,036 acres.

Placer, one of the narrow counties that extends from the state-line westward to the Sacramento valley, has Bear river for a part of its northern and the north and middle forks of the American river for the greater part of its southern boundary. A number of other large creeks, either tributary to the latter river or flowing independently toward the Sacramento, aid in supplying an abundance of water for mining or irrigation purposes. The forks of the American river flow through deep cañons and narrow gorges, which are from 1,800 to 2,000 feet below the general level of the country. Lake Tahoe covers a large surface on the high Sierra region on the east.

The county is naturally divided into the following general regions: (1.) The *high Sierra Mountain region*, on the east, rising from 7,000 to 10,000 feet above the sea, and embracing a wild and rugged country subject to heavy snow and land slides, well timbered with pine, fir, and cedar, and but little inhabited. (2.) An *upper foot-hill region*, from 2,000 to 4,000 feet, extending westward to near Auburn, and embracing a broken and very hilly country, well timbered, and devoted chiefly to lumbering and mining. (3.) A *lower foot-hill region* of less than 2,000 feet altitude, embracing a region of rolling lands and low hills, somewhat broken in character, and partly timbered with white, live, and black oaks, Sabin's pine, buckeye, manzanita, and chaparral. These hills are devoted chiefly to fruit culture, and the valleys to hay and alfalfa. That part of the region reaching from 2 miles west of Auburn to the higher hills has chiefly red gravelly lands, while the remainder is granitic in character, and its soils are lighter and partly sandy. Both are well adapted to fruits. Granite bowlders and outcrops are abundant. This granitic belt extends through the county north and south with an average width of about 10 miles. (4.) The *Sacramento plain*, with an elevation of about 40 feet above the sea, and embracing a level or slightly undulating country, with swales or depressions, and almost treeless, except along the water-courses, where a few oaks vary the monotony. The line dividing the plains from the foot-hill region passes from Folsom (Sacramento county) to Rocklin, and thence eastward of Lincoln and Sheridan to Bear river, on the north.

The soil of the valley or plains is a red loam, with a stiff clay subsoil underlaid by a yellowish hard-pan; within the swales or depressions the stiff clay appears as an adobe, the county greatly resembling that of Sacramento. The lands under cultivation average 68.8 acres per square mile for the county at large, or about 152 acres for that part outside of the mountainous portion.

The Central Pacific railroad, with its Placerville branch, affords the western part of the county abundant transportation facilities, also passing near the northern border of the eastern or mountainous country.

EL DORADO.

Population: 10,683.

Area: 1,800 square miles.—Lower foot-hills, 780 square miles; higher foot-hills and mountains, 1,020 square miles.

Tilled lands: 33,949 acres.—Area planted in wheat, 1,360 acres; in corn, 13 acres; in oats, 57 acres; in barley, 1,137 acres; in vineyards, 1,415 acres.

El Dorado county reaches from the state-line westward almost to the level plains of the great valley, and is watered by the American and Cosumnes rivers and their many tributaries. The former, rising in the extreme east, flows centrally through the county with a channel far below the general level of the country through which it passes. Lake Tahoe extends into the county on the northeast, while several smaller lakes occur within this mountain region.

The eastern part of the county, reaching westward to within 10 or 12 miles of Placerville, is high, mountainous, and rugged, embracing the high Sierra, which rises to an altitude of 8,000 feet and more. The western slope of this mountain region is heavily timbered, and lumbering is the chief industry.

The rest of the county, embracing a belt about 30 miles wide, is a region of foot-hills, and contains a scattered growth of white and black oak and pine, except in the extreme west, which is mostly destitute of timber. From its elevation of about 2,000 feet on the east the surface of the foot-hills falls westward to the plains, hilly and broken at first, but becoming more level, and embraces the only farming lands of the county. Many small valleys occur in the eastern foot-hills region, but these are said to have suffered very greatly by the washing away of their soils by placer mining.

The lands of the county are chiefly red gravelly loams and, clays, and, along the streams, strips of alluvial loams. The cultivated lands average for the county at large 18.8 acres per square mile, while the average of population is not quite 6 persons.

The Sacramento and Placerville railroad runs from Sacramento to Shingle springs, 10 miles from Placerville.

SACRAMENTO.

(See "Great valley region".)

AMADOR.

Population: 11,384.

Area: 540 square miles.—Sierra mountains and upper foot-hills, 90 square miles; lower foot-hills, 450 square miles.

Tilled lands: 36,785 acres.—Area planted in wheat, 2,386 acres; in corn, 1,191 acres; in oats, 31 acres; in barley, 3,291 acres; in vineyards, 580 acres.

Amador county is very narrow, and lies east and west between the foot of the high Sierra and the Sacramento plain, being bounded on the north in part by a fork of the Cosumnes river, and on the south by the Mokelumne river. Numerous creeks, flowing independently of these rivers westward towards the Sacramento, aid in supplying the county with an abundance of water.

The eastern portion is very narrow, and for a distance of 25 or 30 miles is embraced within the upper foot-hills region, having an elevation of from 2,000 to 4,000 feet above the sea; its surface is rugged and broken (the streams finding their way through deep cañons) and well timbered. The rest of the county, or lower foot-hills region, is hilly and partly timbered, and is interspersed with numerous fertile valleys, varying in length from 3 to 6 miles and in width from 2 to 3 miles. Ione and Jackson valleys are each 12 or 15 miles long and from 2 to 5 miles wide. The soils are a red loam, more or less gravelly, with a scattered growth of oaks. The chief crops are wheat, barley, potatoes, and fruits. Irrigation is necessary, and water is brought in ditches from the large streams. The largest of these, the Amador canal, is connected with the north fork of the Mokelumne river, and has a length of 60 miles. The lands yield from 20 to 30 bushels of wheat and 25 bushels of barley per acre.

The western part of the county is connected with Sacramento and San Francisco by the Amador branch from Ione City to Gault, and thence by the Central Pacific railroad.

Lands under cultivation average 68.1 acres per square mile for the county at large, or about 81 acres for the foot-hills region.

SAN JOAQUIN.

(See "Great valley region".)

CALAVERAS.

Population: 9,094.

Area: 980 square miles.—Lower foot-hills, 800 square miles; higher foot-hills, 180 square miles.

Tilled lands: 29,414 acres.—Area planted in wheat, 807 acres; in corn, 206 acres; in oats, 13 acres; in barley, 1,926 acres; in vineyards, 328 acres.

Calaveras county is bordered on the north and south respectively by the Mokelumne and Stanislaus rivers, which, rising not far from each other in the Sierra, rapidly diverge as they flow southwestward and give to the county a triangular shape. These two rivers, with Calaveras river, which rises near the center of the county and flows westward, are the principal streams, and have numerous small tributaries. The surface of the county is hilly and broken throughout, the western boundary resting among the lower foot-hills near the great valley. The general level rises rapidly to the summit of the high Sierra on the east.

Bear mountain, a rocky, wooded range, a little more than 2,000 feet high, strikes northerly across the middle of the county from the Stanislaus to the Calaveras river, dividing this central portion into two sections, the lower composed of abrupt foot-hills, that gradually subside into low, rolling prairies as they stretch west toward the great San Joaquin valley, while the upper grows more rugged and broken as it extends eastward into the main Sierra. * * * The upper and steeper slopes of the foot-hills are covered with scattered groves of oak, interspersed with an inferior species of pine, buckeye, manzanita, and other shrubby trees. Large patches are covered wholly with the chamisal (*Adenostoma*), an evergreen shrub with a delicate leaf, which, seen from afar, gives to the mountains a beautifully dark, umbrageous appearance.

One of the greatest curiosities in California consists of the Big Tree grove, situated on the divide between the middle fork of the Stanislaus and the Calaveras river, about 20 miles east of Mokelumne hill, and at an elevation of 4,759 feet above the level of the sea. The trees range in height from 150 to 327 feet, and in diameter from 15 to 30 feet.—*Natural Wealth of California.*

Mining is the chief industry of the county, and comparatively little farming is carried on. The lands under cultivation average but 30 acres per square mile for the county at large, being chiefly embraced in the lower foot-hill region. Fruits comprise the principal crop. The soils are chiefly the "red foot-hills", similar to those of Tuolumne county. Numerous canals have been dug from the rivers to convey water for hydraulic mining and other purposes, the two largest of these, the Mokelumne Hill and Seco canal on the west, connecting with the Mokelumne river, and the Murphy canal, in the eastern part of the county, taking its water from the Stanislaus river.

Transportation facilities are afforded the western part of the county by the San Joaquin and Nevada railroad, which extends westward through San Joaquin county, along the south side of Mokelumne river, to Brack's landing, where a line of boats connects with San Francisco; also by the Stockton and Copperopolis railroad, reaching from the southwest part of the county west to Stockton, and thence by railroad or boat to San Francisco or Sacramento.

TUOLUMNE.

Population: 7,848.

Area: 1,980 square miles.—Lower foot-hills, 520 square miles; higher foot-hills and Sierra mountains, 1,460 square miles.

Tilled lands: 23,861 acres.—Area planted in wheat, 4,055 acres; in corn, 24 acres; in oats, 69 acres; in barley, 2,558 acres; in vineyards, 418 acres.

Tuolumne, one of the foot-hill counties, is separated from Calaveras on the northwest by the north fork of the Stanislaus river, which, with its tributaries, drains that portion of the country. The greater part of the county is, however, watered by the Tuolumne river and many tributaries, that, rising in the Sierra, flow westward, its drainage basin being entirely within the county until the western boundary-line is reached. The surface of the country is hilly and broken, rising rapidly from the lower foot-hills, near the San Joaquin plains, eastward to the high Sierra mountains, 14,000 feet above the sea. The greater part of the county, because of its hilly and broken character and its elevation, is untillable. The lower foot-hills in the west, where not too broken, are being successfully cultivated in grapes and fruits, while the narrow valleys are planted in alfalfa and grasses for hay. This western region, and especially the valley of the Stanislaus river, has been occupied chiefly with mining camps, quartz mining being a large industry. Lumbering is also carried on extensively in the timber region of the Sierra, "which is located

about centrally with reference to the eastern and western boundary-lines of the county, and extends the entire breadth, its area being about 50 miles long and 25 wide." The timber comprises pine, fir, and cedar, and a number of saw-mills are located upon the western limit of the region. In the mountainous portion of the county, on the east, there are many lakes at the heads of the tributaries of Tuolumne river. Lake Elnor, the largest of these, is situated in a valley 4 miles long, and averages 1½ miles in width. The land bordering it is a sandy loam, producing a luxuriant growth of native grasses. A portion of the valley is well wooded, and the gentle slopes and ridges on both sides are covered with a giant growth of pines and firs. Numerous canals have been constructed, mainly for nursery purposes, to carry the waters of the rivers to many points in the county. The Big Oak Flat canal is some 40 miles long, and that of the Tuolumne County Water Company (the "Tuolumne ditch") about 35 miles.

The cultivated lands average 12 acres per square mile for the county at large, the average population being but about 4 persons per square mile.

The San Joaquin and Nevada railroad, when completed, will give the county good transportation facilities. At present communication is by way of the Southern Pacific railroad in Stanislaus county.

ABSTRACT FROM A DESCRIPTION BY JOHN TAYLOR, OF CAMPO SECO.

There is a belt of granite passing through this county in a course parallel with the Sierra mountains and separated from it by slates. Sonora, the county-seat, is situated upon the divide between these granite and slates. The timber of the county also occurs in parallel belts. From the summit of the Sierra westward for about 40 miles in width toward the foot-hills is the belt of sugar pines. This then gives place to a belt of live-oak and the yellow or nut pine trees, the region being characterized as being the poorest in the county except in minerals. Nothing can be more barren than these pine and chaparral hills, some of which are quite high and conical in shape. The small valleys that intervene are the only portions suitable for settlement. Their soils vary from light to dark, and with irrigation can be made to produce well. The area suitable for farming purposes is quite extensive north of Sonora, and a great quantity of hay is produced. On the western side of the county the great plains are skirted by a belt of scrub oak some 10 or 12 miles in width. The soil is of a brownish color, and is used mostly for pasturage, but by cultivation it is capable of producing cereals.

STANISLAUS.

(See "Great valley region".)

MERCED.

(See "Great valley region".)

MARIPOSA.

Population: 4,339.

Area: 1,560 square miles.—Lower foot-hills, 530 square miles; higher foot-hills and Sierra mountains, 1,030 square miles.

Tilled lands: 15,125 acres.—Area planted in wheat, 337 acres; in corn, 30 acres; in oats, 12 acres; in barley, 1,314 acres; in vineyards, 43 acres.

Mariposa county reaches eastward from the edge of the San Joaquin plains, across the foot-hills, far into the Sierra mountains, its altitude thus varying from about 300 to from 10,000 to 13,000 feet, that of mount Dana being 13,227 feet. The largest stream of the county is the Merced river, which rises on the extreme east and flows westward to the plain. On the south Chowchilla river forms part of the boundary between this and Fresno county, while numerous smaller streams flow westward into Merced county. The eastern part is timbered with pine, spruce, and cedar, the central with oak and pine, while the western is sparsely timbered, and the extreme west is almost treeless.

The most prominent point of interest in the county is the celebrated Yosemite valley, situated on the east at an elevation of 4,060 feet above the sea. The valley proper is about 8 miles long and from one-half to one mile wide, the greatest breadth being 3 miles. The Merced river flows through it, while on either side are very high cliffs, rising in places thousands of feet above the valley. On the lower mountain slopes and in the valley are groves of pine, with some oak, willow, and cottonwood. This valley is famous for the grandeur of its mountain scenery and waterfalls, and is under state control as a place of resort for tourists. Its further description lies outside of the province of this report.

The mountainous portion of the county, too high and broken for cultivation, extends westward to within a few miles of Mariposa, the county-seat. A region of foot-hills of from 2,000 to 4,000 feet altitude then crosses the county from northwest to southeast, and reaches westward about 15 miles beyond the county-seat and into the southern part of the county. It is hilly and broken, interspersed with prominent mountain chains, and is well timbered with pine and oak, the source of supply for the mining camps of the region. Very little farming is done in this part of the county, except on a small scale in the valleys. The extreme western part is more level, its hills being susceptible of cultivation, and is but sparsely timbered with white and blue oaks. The soil of the hills is mostly a reddish clay, that of the valleys or lower lands being chiefly a dark loam with red subsoil. Some farming is done in this lower foot-hill region, small grain, fruits, and vegetables being produced. The county is, however, chiefly engaged in mining, and these supplies are produced mostly for home consumption. Lumbering is also carried on in the higher foot-hills and mountain region.

The average acreage of tilled lands per square mile of the county at large is but 9.6 acres, but, assuming that the lower foot-hills embrace nearly all of the lands under cultivation, the average for that region is nearly 30 acres. Merced is the nearest railroad point for transportation facilities.

FRESNO.

(See "Great valley region".)

TULARE.

(See "Great valley region".)

KERN.

(See "Great valley region".)

SOUTHERN AND DESERT REGIONS.

(Embracing the counties of Los Angeles, San Bernardino, and San Diego.)

LOS ANGELES.

Population: 33,381.

Area: 4,750 square miles.—Coast Range mountains, 2,305 square miles; valley lands, 1,480 square miles; desert, 965 square miles.

Tilled lands: 195,055 acres.—Area planted in wheat, 29,349 acres; in corn, 22,771 acres; in oats, 78 acres; in barley, 38,823 acres; in vineyards, 4,161 acres.

Los Angeles, the most populous of the counties of the southern region, borders the ocean on the south, while its northern boundary lies in the Mojave desert. A range of high mountains, the San Fernando and Sierra Madre, passes through the county with a course a little south of east and an extreme width of about 30 miles, separating the Mojave desert from the southern region of large valleys and hills, which comprise the inhabited and cultivable portion of the county, and which alone is well watered by numerous streams rising among the mountains and flowing into the ocean. Of these the most important are the Los Angeles river, rising on the northwest in the San Fernando mountains and valley; the San Gabriel, rising on the northeast, and uniting with the former a few miles from the ocean; and the Santa Ana river, which, also rising on the northeast in the San Gabriel range and flowing through San Bernardino county, enters this county from a cañon in the Santa Ana mountains of the southeast.

The Mojave desert region, on the north, elevated more than 2,000 feet above the sea, is a desolate sandy plain without permanent streams of water and little vegetation other than, locally, *Yucca*, sage-brush, some creosote plant (*Larrea*), and occasionally juniper and scanty grass. Water may be obtained in wells, but the region, because of the high and hot winds, which stunt or prevent the growth of vegetables or crops, save in protected spots and with irrigation, is hardly inhabited. There is said to be some good land, well adapted to fruits and small grain, in the foot-hills around Lake Elizabeth, on the western border of the desert, but the same causes have thus far prevented their utilization or occupation. There is also a large amount of alkali land in the low grounds of this section.

The mountain region that passes through the county is the continuation of the Coast range, and is made up of high chains, trending in every direction, and, except in some of the passes, too rough and broken for tillage. The eastern and northern slopes are said to have many rich and fertile cañons, which are well timbered with oaks, but are not under cultivation. The Soledad pass, through which the Southern Pacific railroad has been built, trends westward to the Santa Clara river, and its lands are mostly sandy and gravelly, and have a vegetation comprising, in places, oak, willow, cottonwood, and sycamore, with alfilerilla, clover, bunch-grass, and sage. The adjoining mountains are largely covered with chamisal brush. The agricultural region proper of the county, embracing that part lying between the mountains and the coast, is from 15 to 30 miles wide, and is divided into three large valleys: the San Fernando valley on the northwest, separated from the coast and Los Angeles plain by the Santa Monica mountains; the Los Angeles valley, which reaches from the Santa Monica mountains southeast along the coast to the San Diego county-line; and the San Gabriel valley and its eastward continuation into San Bernardino county, separated from the Los Angeles valley and the coast by the Santa Ana range of mountains. The two latter valleys form what is known as the Los Angeles plain, itself divided into an upper and lower, the latter reaching from the coast inland for 10 or 15 miles. These valleys have been somewhat fully described in the regional descriptions on page 37 of this report. The lands embrace dark and rich loams, black adobes, reddish mesa lands, and belts and tracts of alkali land, the latter occurring chiefly in the lower plain.

The *lower plain*, along the coast, is the corn-growing region of this part of the state, its moist lands needing no irrigation and producing fine crops. Gospel swamp, southeast from Westminster, comprising a very low tract on either side of the Santa Ana river, reaches 10 or 12 miles from the mouth, and has a width of 6 or 8 miles. This tract is especially noted, its yield being from 80 to 100 bushels per acre. Here also "pumpkins forget to stop growing".

The crops of the county embrace corn, wheat, barley, and rye, while oranges, lemons, olives, figs, grapes, and other fruits are also grown. Irrigation is, however, generally necessary, and to secure all the advantages possible farmers have organized themselves into colonies in the several regions and have constructed ditches from the streams to supply the needed water. The ditches from the Los Angeles river have a total length of 72 miles, and bring water chiefly to the region of the city of Los Angeles. Two ditches are taken from the San Gabriel river at the point where it leaves the mountains. One of these, the Azusa ditch, is, with its branches, about 30 miles long, but its supply is limited. The Duarte ditch is 12 miles long, and its supply is also limited.

From the two branches of the lower portion of the San Gabriel, between the Coast range and the sea, there are at least twenty-three ditches of more or less importance, the largest of which is the Arroyo, which is 9 miles long. The beds of the streams are so shallow that water is diverted from them without difficulty by means of simple and inexpensive dams of brush and sand.

The Santa Ana river supplies water to two important canals, as well as to a number of small ones. The Anaheim canal is 8 miles long; but much water is lost in the coarse sandy soil, and its banks are protected against erosion by willow trees. The Cajon canal heads at Bedrock cañon in the Coast range, and follows along the face of the broken hills for 8 miles before reaching the plateau overlooking the valley. Its total length is 14 miles, and 25 miles of main distributing ditches have been constructed.

The Santa Ana canal has a total length of 20.5 miles. At 8 miles from its head it divides, one ditch skirting around the rim of the valley, and the other passing across the valley, through Orange, to Santa Ana.

The average of lands under cultivation for the county at large is 41 acres per square mile; but on the supposition that nearly all the lands are included in the valleys south of the mountains we find the average to be about 131 acres per square mile.

The county is connected by the Southern Pacific railroad with San Francisco on the north and with the Atlantic and Gulf ports on the southeast. Branch railroads also run south to the coast from the city of Los Angeles, and there connect with the Pacific coast line of steamers for the north and south.

ABSTRACT FROM THE NOTES OF N. J. WILLSON, OF THE SOUTHERN PACIFIC RAILROAD.

In the desert region along the railroad, altitude 2,350 feet above the sea, in the northern part of the county, the lands are sandy, with much alkali, and have a vegetation embracing yucca, juniper, sage-brush, and salt-grass. There are no habitations. At *Alpine station* (2,820 feet), in Soledad pass, the soil is a coarse red sand, with alfilerilla, sage, and juniper, and the winds are too severe here for even vegetable crops. To the westward the elevations of the stations diminish, the pass being in places quite wide and bordered by high, steep, and rocky mountains. Oak, willow, cottonwood, alder, and manzanita trees, together with Spanish bayonet, yerba santa, and wild sunflower, alfilerilla, clover, bunch and salt grass, sage, and wild buckwheat, are first seen at Rowena. The soil is gray, sandy, gravelly, and rocky, becoming more loamy at Kent station, and a few acres are under cultivation in hay, corn, and vegetables; fruit trees do not thrive. At *Kent station* the Soledad cañon runs out into the Santa Clara valley, which here is about a mile wide. The hills are covered with sage and chaparral brush. At *Newhall station*, on the north side of the San Fernando mountains, the valley is very open, with a few cottonwood, oak, sycamore, and willow trees, while on the mountains there is a heavy growth of chamisal and other brush. The soil is a sandy loam, and has been under cultivation in wheat, yielding 1,124 pounds per acre. The blossoms of fruit trees are liable to be killed by frost. Water is obtained from the artesian well of the California "Star" oil (petroleum) works. The soil at the stations in *San Fernando valley*, the first of the great valleys of the county, is a sandy loam, without timber growth, the only vegetation being alfilerilla, clover, sage-brush, some tar-weed, cactus, and scrub oaks. Water is obtained usually from wells, though some wells have been sunk 100 feet without success. Some of the lands are under cultivation, the chief crops being wheat and barley, the yield of the former being 30 bushels per acre. Fruit trees and grape-vines do well. Hot, dry winds are liable to blow at any time after the middle of March, and fog is occasionally driven into the valley as far as San Fernando station, in the upper part of the valley, which has an elevation of 1,060 feet.

Santa Monica is situated on the coast southwest of Los Angeles, and on a plain which is some 75 feet above the sea. The land to the north and east is level, and has a dark loam soil, while on the southeast the land is rolling and soil sandy. There is no natural timber growth, but some 3 or 4 miles north there are sycamores, and on the hills oaks and a small tree whose root is as large as a barrel and is used for fire-wood (mesquite). Wheat and barley are the chief crops, and orange, lemon, lime, and other fruit trees grow well.

At *Compton*, south of Los Angeles, the lands are quite level, with slopes to the south and east, and without timber, except on the river. The soil is a sandy loam 3 inches deep, changing half a mile to the west to a dark micaceous loam, while to the eastward it soon reaches a depth of 4 feet. The natural vegetation is alfilerilla, clover, "mabra," squirrel-grass, and salt-grass. There is some alkali land in the low places and some mesa lands near the coast which are free from the alkali which makes much of the coast lands unproductive.

Eastward, at Downey, Norwalk, and Anaheim stations, the country is comparatively level, naturally treeless, and largely under cultivation, the soil being the dark and fine micaceous and mouse-colored loam that occurs near Compton station, and in the low places contains alkali, with salt-grass. Still eastward, at *Santa Ana*, 135 feet altitude, the lands are of a sandy, light-colored loam character, extending east, north, and west, while to the south they are more gravelly. The river growth is willow and elder, and in the valley there is a growth of sycamore. Alkali lands occur 1½ miles on the southwest. The crops of this southern region are corn, wheat, barley, etc., with fruits of many varieties; grapes also do well. Cotton has been tried, and, while growing well, the bolls do not open, and the crop is therefore a failure. The yield of corn is about 40 bushels, and that of barley 35 bushels per acre. From April to November southwest trade winds prevail during the day, and during the nights fogs roll in from the coast. From November to March several spells of northeast dry desert winds usually occur, but last not more than a day, doing little damage. A few sand-storms also come from the southwest as well as from the east, at times doing some damage. In the region of *Monte station*, east of Los Angeles city, there are two kinds of lands, known as the upper and lower, or moist lands, the former being devoted to small grain, the lower to corn and potatoes. The soil is sandy, and has a natural vegetation of alfilerilla, clover, mustard, and tar-weed; and there is considerable underbrush (principally elder, wild grapes, gooseberries, and blackberries), which is very thick in places; also some willow, cottonwood, and a few sycamore trees. Wells are from 8 to 10 feet deep, and furnish an inexhaustible supply of water.

Puente station is situated at the western or lower end of the San José valley, where it opens out into the Azusa and La Puente valleys at an elevation of 320 feet. The lands here are black and stiff clays or adobe, while that of Azusa valley is a reddish and fine loam. The vegetation is alfilerilla, clover, and some pepper-cress; the natural trees are the willow, and on the hills to the south oak and some black walnut. The principal industry is sheep-raising.

Spadra station is situated in San José valley at an elevation of 700 feet. This valley will average 1 mile in width, and extends nearly to Pomona station. The soil at this station is a dark loam, and is largely under cultivation, yielding from 30 to 50 bushels of barley per acre. The lands are irrigated by ditches from the creek. There is some little alkali land throughout various portions of the valley. Considerable fog is brought in by the trade winds.

Around *Pomona station* and eastward the lands are chiefly light, sandy loams, rather dark in color, and without trees, except an occasional sycamore. The crops are wheat, barley, alfalfa, corn, potatoes, etc. The lands are irrigated from springs and wells. Trade winds blow through the San José valley and occasionally bring in fog. Several artesian wells have been bored a short distance north of Pomona, but attempts in other places have been unsuccessful. Water for ordinary purposes is obtained from wells at a depth of about 45 feet; but in many instances the wells have gone dry, but are recovered by sinking a little deeper. The planting of grapes and citrus fruits has been extensively begun in this region of late, and land is held at high prices.

ABSTRACT FROM A DESCRIPTION BY WILLIAM R. OLDEN, OF ANAHEIM.

The great valley of Los Angeles county, lying between the foot-hills and the coast, is about 40 miles long and 20 wide from northeast to southwest, of which width 15 miles is bottom land and 5 miles mesa or table-land, lying adjoining the foot-hills of the Santa Anita range. The mesa lands have a soil of great fertility and depth, which, when moist, is of a dark chocolate color, very easy to cultivate, and absorbs and retains moisture to a remarkable extent.

The valley lands are alluvial in character. Traces of old river channels are found crossing the valley, generally parallel, a mile apart, and are invariably ridges coarse sand from 50 to 100 yards in width. Between these ridges are broad swales of rich soil from 5 to 10 feet in depth, underlaid by quicksand and pipe-clay. The slope of the valley from the foot-hills to the sea averages 13 feet per mile, the pipe-clay being the same, thus accounting for the natural moisture and perpetual verdure that prevails throughout the valley. The only natural timber in this valley region is sycamore, cottonwood, and willow, with live-oak in the hills and pine and fir on the mountains. The crops embrace wheat, rye, barley, oats, corn, and alfalfa, besides oranges, lemons, limes, figs, bananas, olives, grapes, and berries. The valley lands comprise *heavy sandy loams*, slightly alkaline, with a natural growth of burr, clover, alfilerilla, and mustard; *light sandy loams*, with the same growth; and rich *sediment soil*, always covered with green vegetation. All are easy to cultivate, and yield fine crops.

ABSTRACT FROM A DESCRIPTION OF THE SANTA ANA VALLEY BY J. D. TAYLOR, OF ANAHEIM.

The Santa Ana river leaves the foot-hills from a cañon about 20 miles from the coast. The northern or upper half of this valley is not productive in dry seasons without irrigation; but the lower half is more moist and generally covered with green vegetation, and is interspersed with sand streaks and alkali or salt spots. The central, east, and west portion of this valley embraces an artesian belt, in which a number of wells have been successfully bored to a depth of about 200 feet. The high lands on the foot-hills adjoining the valley are generally sloping, and considerable of this can be used for grain in wet seasons, but is better adapted to pasturage. The mesa lands on the coast are, if anything, better for grain, because of the heavy fogs and dews, which are more frequent there.

SAN BERNARDINO.

Population: 7,786.

Area: 23,000 square miles.—San Bernardino mountains, 2,950 square miles; valley, 465 square miles; desert, 19,585 square miles.

Tilled lands: 25,601 acres.—Area planted in wheat, 2,558 acres; in corn, 774 acres; in barley, 4,076 acres; in vineyards, 1,215 acres.

San Bernardino is the largest county in the state, and reaches from the eastern state-line southwestward to within a few miles of the coast, the Colorado river, forming a part of the eastern boundary, separating it from Arizona. It is chiefly a part of the great Mojave desert, and the habitable portion of the county is very small, and is included in the southwestern corner, on the coast side of the San Bernardino range of mountains.

Mojave desert is described as a sandy and barren waste, interspersed with volcanic mountain ridges and peaks, salt lakes and alkali tracts, destitute of all growth except Yucca, small nut pines, and juniper, and having but one or two streams. The Mojave river rises in the San Bernardino mountains, on the south, and flows for about 100 miles out on the desert and suddenly disappears.

The San Bernardino mountains of the southwest are thickly timbered with pine, cedar, hemlock, and maple, and are high and impassable, except through a few passes. These mountains are separated from the Temescal and Santa Ana range on the southwest by a broad valley, which embraces the only agricultural lands of the county, and is a part of the valley region that covers a large part of Los Angeles county. Santa Ana river, the chief stream of this part of the county, rises in the San Bernardino mountains, and, with many small tributaries, flows southwestward across the valley and across the Santa Ana mountains to the ocean. It is timbered with cottonwood and willows. Santa Ana valley is divided by a chain of buttes into two parts, the northern receiving the name of the county. The San Jacinto mountains inclose the valleys on the east, the chief outlet thus being on the west into the Los Angeles plains and to the coast. This valley has, until the past few years, been occupied solely by stock-raisers; at present, however, its agricultural value is being rapidly developed by a system of irrigation by waters from the mountains and from artesian wells, of which a number have been bored. A number of colonies have been established, and large areas have been planted and made to produce large crops of grapes and fruits of many varieties, prominent among which are raisin grapes, oranges, and lemons. The Cucamonga colony, not far from San Bernardino, and the Riverside colony, occupying a plateau on the south of the chain of buttes, are well known for their excellent fruits.

The surface of Santa Ana valley presents a gently undulating or level plain, gradually rising toward the hills from the river, and in places is studded with trees. The soil is a reddish-gray, gravelly loam, rather stiff in the center of the valley, becoming more and more sandy, and in part gravelly, as the hills are approached; but that at Riverside is red and clayey in character and of great depth. The lands are free from stones, and are said to produce, when fresh, as much as 35 bushels of wheat or 50 bushels of corn per acre.

The foot-hills have a red gravelly soil, and, with the mesa or bench lands, are excellent for fruits. The valley, surrounded as it is by high mountains, is thus partially protected from the hot and parching winds of the desert, except in the early part of the season, when north winds prevail. The dryness of the climate adapts the valley region especially to raisin making, and Cucamonga is noted for its sweet wines.

The lands under cultivation in the county, if referred entirely to this valley region (as they probably should be), average 55 acres per square mile; but for the county at large the average, if distributed, would be only 1.1 acres per square mile. Barley and wheat are the chief field crops, but vineyards and citrus orchards are being rapidly brought into prominence.

The valley is supplied with many canals and ditches, which take water either from the Santa Ana river or directly from the mountains. From the river there are two ditches, the north fork and the south fork, each 8 miles long, and taking water where the river emerges from its cañons. Two canals supply the Riverside settlement. They are the largest in the county, and are, respectively, 12 and 14 miles in length, and take the waters from the mountains. Cucamonga and other districts are supplied with ditches of less length from mountain streams.

The Southern Pacific railroad passes through the San Bernardino valley, thus connecting their agricultural portion of the county with San Francisco on the one hand and with the Atlantic states on the other.

ABSTRACT FROM NOTES OF N. J. WILLSON, OF THE SOUTHERN PACIFIC RAILROAD.

The surface of the country west of *Cucamonga station* is very level, with sand belts aggregating some 3 or 4 miles in width, having a growth of sage and other brush. With these exceptions there is a fine growth of alfilerilla and some bunch-grass. No farming is done; some trees are planted at the station. Cucamonga ranch is 3 or 4 miles north of the station, and from there water is brought in pipes to Colton. The soil is very sandy, in some places pure sand, which drifts with light winds. There is a fair growth of grass in places, but as a general thing sage and other brush predominate.

Around *Colton* (960 feet) the land is generally level, though there are places slightly rolling. The soil is sandy, and has a growth of alfilerilla, clover, and pepper-grass, and sage-brush is plentiful. The only natural trees are on the Santa Ana river, and comprise willow, cottonwood, and alder. In this vicinity and near San Bernardino there are upward of 350 artesian wells from 60 to 300 feet deep. Other irrigating water is brought from Santa Ana river. Wheat is the most important crop, and yields some 30 bushels per acre. At times grain is troubled with frost, and dry north winds blow occasionally and do a great deal of damage to crops. Some fog is blown in, but not enough to do harm.

The San Mateo valley, or *San Gorgonio pass* (elevation 1,850 feet), extends from near San Gorgonio to within a mile of Mound City, or old San Bernardino, and will average one-fourth of a mile in width. It is cultivated from a short distance southeast of Mound City to 3 miles above El Casco. The soil is a sandy loam, overlying gravel at about a foot, and has a growth principally of alfilerilla, some clover and salt-grass, and some cottonwood and willow on creek bottoms. The hills on either side are covered with a heavy growth of low brush, and in the lower end of the valley some chollu, yerba santa, sage, etc. The chief crops are wheat, corn, barley, alfalfa, and potatoes, but some fruit is successfully raised. Considerable trouble is experienced from dry winds in the upper end of the valley. *San Gorgonio station* or summit is 2,950 feet above the sea; the land around it is rolling, and approaches the hog-wallow character. There is some alfilerilla and bunch-grass, sufficient for fair pasturage from January to June or July. The only water is from a well about 250 feet deep. No farming is done.

SAN DIEGO.

Population: 8,618.

Area: 14,600 square miles.—Coast Range mountains, with many small valleys, 7,950 square miles; desert, 6,650 square miles.

Tilled lands: 38,247 acres.—Area planted in wheat, 8,929 acres; in corn, 440 acres; in oats, 77 acres; in barley, 3,573 acres; in vineyards, 224 acres.

San Diego, the extreme southern county of the state, reaches from the Pacific ocean eastward to the Colorado river, and ranks as second in size among the counties. More than one-half of its large area is, however, but a barren desert, embracing a portion of the Mojave desert on the northeast and the Colorado desert, or Coahuila valley, in the middle, the two being separated by the San Bernardino range of mountains, which trends northwest and southeast. The Mojave desert lands are interspersed with abrupt mountain chains, and are mostly above sea-level, while the surface of the Colorado desert is quite level, free from these mountains, except on the border, and is in many places from 100 to 250 feet below the level of the sea. Both are covered with sand-hills, alkali lands, dry lakes, and a sparse desert growth of Yucca, cactus, sage, and creosote bushes, and are destitute of water. The winds often blow with great violence, and sand-storms are produced by even moderate winds. This region is uninhabited, except by a few railroad station hands, and therefore is not under cultivation; but on the border of the Colorado desert there is a little land planted in fruits, vegetables, and alfalfa, as stated by Mr. Willson in the notes given on page 109.

The rest of the county west of the desert is mountainous, broken, or hilly, and is divided into two natural divisions, viz, the San Jacinto and Coast range mountainous region and that lying between the Coast range and the coast, embracing hills, mesa lands, and valleys. The San Jacinto mountains, which border the desert, have an altitude of about 5,500 feet. Between them and the Coast range there is a lower region of valleys and hills or table-lands about 3,000 feet above the sea, which is watered by several streams which flow westward into the ocean. The mountains are timbered with oak, cedar, pine, and fir. This valley region is chiefly devoted to stock-raising, and the population is very sparse.

The coast region, embracing a belt of country along the coast about 25 or 30 miles in width, is rather rolling or undulating near the coast, but becomes more and more hilly and broken eastward to the mountains. This region contains nearly all of the population and the chief farming lands of the county. Within this and the mountain region there are said to be more than thirty valleys varying in length from 3 to 15 or 20 miles, and embracing from a few hundred to upward of 20,000 acres. They are well watered by numerous rivers and their tributaries, except during a portion of the summer months; their land is a dark loam, that of the hills and uplands being a red loam or clay, underlaid generally by adobe. Comparatively little of the land of this section is under cultivation, the average probably not being as much as 10 acres per square mile. The crops comprise chiefly wheat and barley, with grapes, oranges, lemons, and other fruits.

San Diego river, in its course among these hills, is bordered by a number of valleys of various extent. Mission valley, near the mouth of the river, being from one-half to 1 mile wide, its surface having a loose sandy soil, destitute of trees, but with a thick growth of bushes. The side hills are clayey and gravelly, and are about 100 feet high.

Cajon valley, 15 or 20 miles from San Diego, is about 6 miles long and 4 wide, and has the appearance of a great basin or box (as its name indicates) hemmed in by high, gently-sloping hills, and is somewhat difficult to reach. The river finds it way out through narrow cañons toward the coast. The surface is level and treeless, except along the river, where there is a growth of cottonwood, willow, and sycamore. The soil, of no great depth, is sandy and gravelly, and is largely cultivated in wheat and other crops. The upper or northern part of the valley is very narrow, and is bounded by lofty hills and covered with a dense growth of willows, with some sycamore.

The Southern Pacific railroad passes through the Colorado desert in the eastern part of the county, while the western part is connected with it at Colton by the California Southern railroad, which extends from San Diego northward. The Pacific coast line of steamers also connects San Diego with San Francisco, the bay of San Diego, with its port, affording anchorage for the largest vessels.

ABSTRACT FROM NOTES BY N. J. WILLSON, OF THE SOUTHERN PACIFIC RAILROAD.

Gorgonio pass, 2,315 feet above the sea, and known as the "Jumping-off place", extends east as far as Whitewater station, and at this point is about 2 miles wide. Its natural vegetation is alfilerilla, clover, and bunch-grass. In the cañons there are willow, cottonwood, sycamore, etc., and on the mountains pine, fir, and cedar. Water for ordinary use and for irrigating a few trees is obtained from a V flume 12 miles in length, which was built for floating wood to the railroad. In this vicinity there are probably about 1,000 acres in wheat and barley. Dry east winds from the desert are pretty bad here, but do not generally blow while crops are in a condition to be injured. Fogs come in occasionally. To *Cabazon station* the country is very dry, and has very little vegetation, except alfilerilla, sage, chollu, prickly pear, and creosote plant. Thence to within 2 miles of Whitewater station it is rocky and gravelly, and beyond this the desert opens up with sand-hills, 3 or 4 feet high, formed by the sand drifting around the bushes. Whitewater river at this place passes into the desert and disappears. There is a small ranch about 1½ miles west, known as Widow Smith's ranch, which was originally a stage stand, where some 30 acres are planted in alfalfa and vegetables. At *Seven Palms*, 580 feet altitude, the sands are underlaid by a hard, compact sediment, the only growth being a little creosote and sage. A stiff wind produces sand-storms, and may come from any direction. The sand-hills extend to within 2 miles of *Indio station*, which is at sea-level. The lands here are quite level. The vegetation is sage, arrow-weed, yerba santa, and mesquite. The latter is very plentiful, and attains a growth sufficient to warrant its being cut and shipped for firewood. Water is obtained at 30 feet. At *Walter's station*, 200 feet below sea-level, the soil is a fine grayish micaceous loam, covered in places with shells. Water is found at 14 feet. Alkali lands give some trouble, and to midway between this and *Dos Palmas* the country is rolling and has no vegetation other than alkali- or salt-weed. Five miles west of Dos Palmas, where the railroad reaches its lowest point, 268 feet below sea-level, there are salt springs, and the ground is white with alkali. From Dos Palmas to Flowing Well station there is scarcely any vegetation, but there are some miles of sand, then salt flats, and pumice is quite plentiful. Near Flowing Wells, at sea-level, the land is better, though sandy, with streaks of gravel, and has a growth of sage and creosote plant. About one mile northeast are dark-red clay hills covered with a compact sand. The clay was cut up in fissures, and these were filled with salt. An ironwood tree occasionally is found here, and a salt-water well has been bored. From here to Pilot Knob station the lands are sandy and are covered to some extent with giota grass, creosote plant, sage, chollu, candlewood, and ironwood. Mesquite does not occur. At *Pilot Knob station* (altitude 280 feet) the surface is gravelly in places, with sand streaks, all of which is underlaid with red soils. Thence to *El Rio station*, near the Colorado, the country is quite rough, being a continuation of rolling hills, some of which appear to be 100 feet high. These hills are made up of compact sand, and are covered with about 6 inches of coarse gravel or pebbles. The vegetation is very sparse. Between the last station and the river the bottom is covered with a heavy growth of mesquite and arrowroot, while on the Arizona side of the river there is a heavy growth of creosote (*Larrea Mexicana*), some of which is at least 15 feet high. The altitude of El Rio is 150 feet, and that of the river bottom about 130 feet.

There is no one living at the various stations throughout the desert, except, perhaps, a few section hands at a few points, and there is none of the land under cultivation.

COAST RANGE REGION.

(South of San Pablo bay.)

(Embraces the following counties and parts of counties: San Francisco, San Mateo, Contra Costa, Alameda, Stanislaus,* San Joaquin,* Santa Clara, Santa Cruz, Monterey, San Benito, Fresno,* Merced,* San Luis Obispo, Santa Barbara, Kern,* Tulare,* and Ventura.)

SAN FRANCISCO.

Population: 233,959.

Area: 40 square miles.—Coast Range mountains or hills, 40 square miles.

Tilled lands: 2,298 acres.—Area planted in oats, 44 acres; in barley, 349 acres; in vineyards, 1 acre.

San Francisco county, the smallest in the state, and embracing little else than the city and suburbs, is bounded on the west by the ocean and on the east by the bay of San Francisco, and is separated from the counties on the north by the Golden Gate. Its position is thus near the end of a peninsula whose surface is little else than a region of sand-hills on the west and rocky ridges on the east, originally covered with a brush growth, and rising high above the waters of the bay. Sandstone and serpentine rock formations underlie the hills and outcrop on some of the highest points, as well as at cliffs and bluffs along the shore lines. The county is not an agricultural one, and very little of its land is under cultivation, except in vegetable or "truck" farms. The even temperature permits the cultivation of temperate-zone vegetables throughout the year, while the average is too low for the ripening of fruits. Heavy fogs, brought in by the trade-winds from the ocean, prevail during the summer months, and on the seaward slope more or less throughout the year. The city is situated upon the hills and flats that border the bay on the eastern side of the county, and has a population of 247,000, comprising representatives from almost every nation on the globe. With its extensive wharfage along the bay, its capacious harbor extending far inland through other connected bays, opening out through the Golden Gate upon the great highway to Asia, and affording safe anchorage for the largest vessels, it may well be called the metropolis of the West.

SAN MATEO.

Population: 8,669.

Area: 440 square miles.—Some redwood; Coast Range mountains, 390 square miles; valleys, 50 square miles.

Tilled lands: 73,986 acres.—Area planted in wheat, 10,767 acres; in corn, 118 acres; oats, 7,376 acres; in barley, 16,705 acres; in vineyards, 39 acres.

San Mateo county, bordered on the east by San Francisco bay and on the west by the ocean, is mostly mountainous, the north end of the Santa Cruz range running the entire length north and south and having an altitude in some places of 3,000 feet. On the south this range is very steep and rugged, and is covered with redwood, oak, pine, and other timber. The natural growth of the lower hills is chamisal brush, manzanita, poison-oak, hazel, etc.

Along the bay shore, on the east, there is a strip of level country from 1 to 5 miles wide, embracing, it is thought, about 69,000 acres, of which 40,000 are tillable; but a salt marsh, whose extreme width is about 2 miles, forms the immediate border of the bay in the southern part of the belt. The soil of the plain around Redwood city, the county-seat, is an adobe, covering about 3,000 acres; but elsewhere, until the sand-hill region is reached, sandy loams prevail, changing to the northward to more sandy soils.

On the ocean shore there is around Half Moon bay another belt of comparatively level farming land about 1 mile wide and 10 miles in length, rising rapidly into the hills and cañons of the interior; also to the southward, at Pescadero, where, at the mouth of a creek of the same name, there is a valley containing about 4,500 acres of good lands, surrounded on all sides, except the west, by high mountains. Here is the famous pebble beach where agates, opals, jaspers, carnelians, etc., are found in great abundance. Elsewhere along the coast the hills reach the water's edge, forming high cliffs and bluffs.

Among the mountains and hills there are many small valleys, which, with the adjoining hills, are chiefly used as pasturage for stock and dairy farms, the principal industry of the county.

In the northern part of the county fogs and cold winds prevail to a considerable extent during the six months from April to October. From the neighborhood of mount San Bruno it grows milder and the severity of the winds is rapidly diminished, until, south of Belmont, they become mild and refreshing breezes, just sufficient to allay the heat of the interior and render the climate healthy, bracing, and delightful. On the ocean coast the thermometer ranges slightly lower than on the bay coast, but the climate is rather more equable, owing to oceanic influences and the fogs which prevail in summer. In the summer dense fogs at times drench the summit of the mountains, and snow falls on them at intervals during most winters, but seldom remains on the ground more than a few hours.—*California As It Is.*

The average of lands under cultivation for the county at large in 1880 was 168.1 acres per square mile, or 26.3 per cent. of the area. The chief crops are wheat, barley, and oats. Potatoes have been produced extensively, but are very liable to blight. At Pescadero much flax is grown. In this county, as in Santa Clara, portions of the mountain slope are known as "thermal belts", on account of their exemption from frosts, as well as from the direct inflow of the sea fog.

The county is connected by railroad with San Francisco.

ABSTRACT FROM A DESCRIPTION OF PESCADERO REGION BY MESSRS. J. H. OSGOOD, E. C. BURCH, B. V. WEEKS, AND W. G. THOMPSON.

The general conformation of the land in the neighborhood of Pescadero is a series of low hills intersected by narrow valleys. The hills to their tops are generally fit for either cultivation or pasturage, and the natural growth is chamisal brush, barberry (a cherry—*Cerasus aquifolium*), manzanita, hazel, poison-oak, wild lilac (*Ceanothus*), and elder. The soil of the north hillsides is deep and fertile, while that on the south sides is comparatively shallow and unproductive, and is susceptible to washing and gullying in rainy seasons. The valleys, less than a mile wide and sometimes only a few rods, are level, and the soil is in layers or strata as washed down from the hills.

The natural timber of the mountains is redwood, pine, oak, madrona, alder, and buckeye. Abundant water for ordinary purposes is supplied by springs. Wells are usually dug from 20 to 60 feet deep. The crops embrace potatoes, oats, and barley, the yield of the two latter being about 4,000 pounds per acre. Dairying is extensively practiced. Northwest winds mostly prevail for three-fourths of the year.

CONTRA COSTA.

Population: 12,525.

Area: 800 square miles.—Great valley, 105 square miles (tules, 25 square miles); Coast Range mountains, 625 square miles; valleys, 70 square miles.

Tilled lands: 232,794 acres.—Area planted in wheat, 71,870 acres; in corn, 55 acres; in oats, 1,280 acres; in barley, 19,674 acres; in vineyards, 325 acres.

Contra Costa county is bounded on the east by the San Joaquin river, and on the north and northwest by Suisun and San Pablo bays. The chief streams are San Pablo, Pinole, and San Ramon creeks, the latter being the largest, and giving its name to one of the principal valleys of the county. These streams flow northward into the bays.

The surface of the county is largely mountainous, having the Coast or Contra Costa range proper on the west, and the Mount Diablo range in the center and on the east. Mount Diablo itself, with its rounded summit, is the highest point in the county (3,896 feet above the sea), and, isolated as it is from other mountains, is the most prominent object. The slopes and higher portion are mainly treeless and afford fine pasturage, but a forest growth, consisting of a great variety of oaks, covers the ravines of the lower portion, while in the higher the nut pine, juniper, and a chaparral consisting largely of scrubby oaks covers large areas. The mountain is nearly treeless on the north side. San Ramon valley, which separates the mountain from the Coast range, reaches from Suisun bay southward across the county, under different names, into Alameda county, where it connects with Livermore valley. Between the bay and the foot-hills of mount Diablo, a distance of about 15 miles, the valley has a width of about 6 miles, but afterward becomes very narrow, averaging from 1 to 2 miles. The soil is chiefly a stiff adobe, and in some cases is exceedingly waxy and black. When fresh, this soil yields about 30 bushels of wheat or 40 bushels of barley per acre.

A number of large valleys, such as that of Walnut creek, flanked by rolling, sloping land, are connected with this on either side, and are also rich and productive. The lands around mount Diablo are partly reddish and more or less gravelly and partly gray loams. Mount Diablo valley, which extends from the foot of the mountain 8 or 10 miles northwestward with a width varying from half a mile to 3 or 4 miles, is very level, and is drained by small streams. Its soils are gravelly loams, with some adobe, and produce fair crops of grain and fruits. Small valleys are found among the Coast Range mountains, and are usually occupied by dairy and fruit farms; but on the east of the Mount Diablo range, sloping gently away from its foot toward the river and reaching north to the bay, there is a large tract of farming land, having a width of from 3 to 6 miles for a distance of 23 miles, which is chiefly given to grain-growing. Still eastward of these, and bordering the bay, are large areas of tule lands, covering, it is estimated, about 75,000 acres. Some of these lands have been protected from overflow by levees, and are under cultivation. The tule region is separated from the San Joaquin river by a narrow Tertiary ridge running northward from the southern part of the county and elevated from 30 to 40 feet above tide-water. This ridge has a sandy soil, and affords fine locations for towns.

Within a few miles around the base of mount Diablo there is a great variation of rainfall. On the west the clouds are apparently caught by the high peaks, with a resulting heavy precipitation, while on the east and south there is but little rain; *e. g.*, at Antioch only from 12 to 14 inches. Some of the valleys running westward into the Coast range are remarkable for their exemption from frost, so that the orange, pomegranate, etc., ripen to perfection.

The lands under cultivation in the county average about 291 acres per square mile, thus placing Contra Costa eighth in the state in this regard. Transportation facilities are afforded both by rail and by boat to San Francisco.

ALAMEDA.

Population: 62,976.

Area: 660 square miles.—Coast Range mountains, 415 square miles; valley, 225 square miles; tule lands, 20 square miles.

Tilled lands: 200,360 acres.—Area planted in wheat, 36,032 acres; in corn, 1,139 acres; in oats, 1,458 acres; in barley, 39,075 acres; in vineyards, 344 acres.

The county of Alameda lies immediately east of San Francisco bay, its shore-line reaching south from San Pablo station to the limit of the bay. Thence the county extends eastward to the summit of the Contra Costa range, and on the south, still eastward, to the Mount Diablo range, inclosing within its limits the valleys of Livermore, Suñol, Amador, and others. The two mountain ranges are nearly parallel with each other, and rise to altitudes of 2,000 feet or more. They are now treeless on the western and southern slopes (except in the cañons, where there are clumps of oak, laurel, madrone, alder, etc.), though originally having some redwood growth, while on the northern and eastern slopes, besides an abundance of chaparral, there is a scattered growth of both live and white oaks, with maple and madrone.

The largest stream of the county is Alameda creek, which drains Livermore valley, and, traversing the Coast range and entering the bay-shore, or "Alameda plains", flows westward to the bay. Its banks are mostly timbered with sycamore and willows. San Antonio and other creeks are tributary to this from the south. Northward from Alameda creek are San Lorenzo, San Leandro, and other small streams, which have their source in the mountains that bound the Alameda plain and flow westward into the bay. On some of these creeks there is a natural growth of oak, willow, sycamore, laurel, madrone, and buckeye.

Reaching back from the shore with a gradual rise to the hills is a broad and nearly level region, the plain of Alameda. This plain extends through the county along the bay with a width averaging about 5 miles, though becoming quite narrow on the north, and is said to have been originally covered with an oak growth; but now there are only a few scattered groves of this timber in addition to the eucalyptus tree, which has been extensively planted in some localities. Nearly if not all of the plain is now improved and largely under cultivation in small grain and orchard fruits, including excellent currants; and in the southern part, especially near Mission San José, vines as well as other fruits flourish. The creeks coming from the Coast range are bordered by tracts of light alluvial soil, cultivated by preference in barley and "garden truck", the latter mainly by Portuguese. The bay shore is bordered by tracts of salt marsh lands, altogether estimated at 35,000 acres, having the usual salt grasses, and penetrated in every direction by lagoons or salt-water creeks, which receive the waters of high tides. At some points the bay shore embraces a narrow strip of sandy soil extending along the beach, while inland of this is a level belt of black adobe or, in places, salt marshes. Toward the hills the lands become more gravelly and lighter colored, and are mingled with bowlders and rock fragments, and there are occasional tracts of adobe lands at the foot as well as on the hills. The region is thickly populated, and numerous towns and villages dot its surface. Oakland, with its population of 34,555, and situated opposite San Francisco, is connected with it by regular half-hourly trains to the end of a long pier or mole (built by the railroad company), and thence by ferry-boats. Berkeley and Alameda also enjoy similar facilities for reaching San Francisco.

The mountain range that borders this plain has mostly rounded summits, but is traversed and cut up by numerous cañons, though well covered with grasses and suited to pasturage and to wheat-growing. The hill soils are usually adobe. The hillsides are partly covered with a chaparral of scrub oaks, poison-oak, groundsel tree (*Baccharis*), bramble, etc., with manzanita on the highest points. From Grizzly and Bald peaks, near Berkeley, probably the highest points in the north part of the range, fine views may be obtained of the bay and city of San Francisco, the Golden Gate, the mountains of the Coast range on either side, and the distant Sierra—Mission peak, near Mission San José, is the highest point in the southern part of the county.

The valleys lying between the two ranges of mountains are accessible from the plains by Stockton pass, a winding ravine leading from the San José valley to Suñol valley, the western third of which shows rather abundant and heavy adobe soil of the hills, the slopes being devoid of trees. Eastward the character of the soil changes, becoming of a lighter hue and containing more loam, sand, and gravel, especially in the bottoms. Oak trees occur in some places. The lands of these hills are partly under cultivation, wheat being the chief crop. Suñol valley, into which the pass opens, is circular in outline, surrounded by hills, and was originally dotted over with oaks; it contains much good farming land. The Vallecitos valley, separated from Suñol only by a low ridge, is rather narrow, being surrounded by high hills, and its surface is mostly level, interspersed with some hills, and is largely under cultivation.

Livermore valley, to the eastward of these, is about 14 miles long and from 5 to 8 miles wide, and is surrounded by rolling foot-hills and mountains. The northern and eastern part of its surface is a plain, the southern and western a region of rolling hills, and all is dotted over with oak trees. It is watered by numerous streams tributary to Alameda creek, and along these there is usually a growth of sycamore. The soil of this and of the other valleys that adjoin it is a gravelly loam, very productive, yielding good crops of grain and fruit, among the latter the vine becoming prominent in the upland or hill portion, the level part being too much swept by coast winds for full success.

Amador valley, on the southeast, is about 8 miles in diameter, and is nearly surrounded by grassy hills, the spurs of the two mountain ranges. Its soil is a sandy loam, and produces good crops of wheat.

The lands of the county under cultivation embrace 47.4 per cent. of the total area and average about 303.5 acres per square mile, the county ranking third in the state, the counties of San Joaquin and Sacramento alone having a greater average.

STANISLAUS.

(See "Great valley region".)

SAN JOAQUIN.

(See "Great valley region".)

SANTA CLARA.

Population: 35,039.

Area: 1,400 square miles.—Coast Range mountains, 995 square miles; Santa Clara valley, 405 square miles.

Tilled lands: 166,184 acres.—Area planted in wheat, 38,623 acres; in corn, 261 acres; in oats, 260 acres; in barley, 29,613 acres; in vineyards, 1,532 acres.

Santa Clara county, with its eastern boundary-line upon the Coast range of mountains and its western upon the Santa Cruz range, includes within its limits mountains, hills, and valleys which are watered by many small streams flowing partly to the north and emptying into the bay of San Francisco and partly south to the Pajaro river, and thence to the bay of Monterey. The most important of these streams are Gaudalupe and Coyote creeks, on the north. The mountains on the west are mostly heavily timbered, while the lower hills are covered with grasses, and well suited to pasturage, especially on the west side, where the fogs from the ocean keep the grass green through a great part of the year. The eastern mountains are treeless, save in the cañons. The prominent feature of the county is the Santa Clara valley, well known for its productiveness and mild climate. With a width of 20 miles on the north, at the southern extremity of San Francisco bay, this valley reaches southward to about 11 miles south of San José, where it becomes only about 100 yards wide, then opens out to several miles in width, and passes into San Benito county. Its surface is somewhat undulating, with low, rounded hills on the margins, and is dotted with clumps and groves of oak. Its lands embrace black adobes on the northern or lower portions and lighter sandy or gravelly loams on the higher lands. The chief crops are wheat, barley, corn, potatoes, and vegetables, and in the neighborhood of San José fruit (especially plums, prunes, and grapes), for which culture the climate and exemption from fogs specially adapt the region. (See further description and analyses of soils on pages 47 and 52.)

The lands under cultivation average for the county at large 118.7 acres per square mile, the average of population being 25 persons per square mile.

Branches of the Southern Pacific railroad, on either side of the bay, connect San José with San Francisco and Oakland; in addition, the South Pacific Coast railroad skirts the western shore of the bay.

SANTA CRUZ.

Population: 12,802.

Area: 420 square miles.—Redwood lands, 195 square miles; Coast Range mountains, with some valley lands, 225 square miles.

Tilled lands: 40,205 acres.—Area planted in wheat, 12,060 acres; in corn, 1,768 acres; in oats, 934 acres; in barley, 5,945 acres; in vineyards, 346 acres.

Santa Cruz is one of the most mountainous counties on the southern coast, the ranges, however, being neither high nor much broken. The eastern boundary-line rests upon the summit of the Santa Cruz branch of the Coast range at an elevation of 2,000 feet or more above the sea, extending south to the Pajaro river, while to the west, and separated by the San Lorenzo valley, is another mountain range reaching southward to the bay of Monterey at Santa Cruz. Still westward to the coast the country is hilly and broken often to the water's edge. In the southern part of the county the Pajaro river forms the boundary-line, and is bordered by a valley region extending east and west and embracing rich dark loam and adobe lands, which are well adapted to wheat and barley. This part of the valley, however, is not wide, as the river flows not far from the hills, thus giving the greater part to Monterey county. Northwestward from this there is another valley region lying east of the town of Santa Cruz, and at the mouth of the San Lorenzo river. It embraces several terraces or benches, which are from a mile to two miles wide and extend through the valley, the first 30 feet above the level of high water, the second 34 feet higher, and the third 199 feet higher still, showing a total rise of 263 feet. The town of Santa Cruz is located upon the lowest of these benches, extending southward by Soquel and Aptos to the Salinas marshes. It has been estimated that the bottom lands of the county embrace 40,000 and the terraced plateaus 50,000 acres.

The county is watered by the San Lorenzo and Pajaro rivers and numerous small streams that flow from the coast mountains to the sea. The mountains are generally heavily timbered almost to their very base with redwood, pine, and chestnut oak, probably to the extent of one-third of the county area, while the lower hills are covered to some extent by hazel bushes. The redwood trees of this county are noted for their great size, many of them attaining a height of from 200 to 300 feet and a diameter of 15 feet. The lands of the San Lorenzo valley north of Santa Cruz have a sandy loam soil, derived from a fine-grained calcareous sandstone, the prevailing rock of the hills, although granite occurs northward of the town of Santa Cruz. The soil is deep in the flats, but easily washes away, and on the hills much rock is exposed. This valley is about 20 miles long, and is most generally used for pasturage, though there are a number of vineyards near Vine Hill, about 10 miles north of Santa Cruz. The valley is very narrow, the river often flowing between high hills, while in other places it opens out into wide plateaus; but the hills on either side are sufficiently low for cultivation, and the Santa Cruz mountains generally are being rapidly occupied for orchards and vineyards. The town of Santa Cruz is a popular summer resort by the seaside. The average of lands under cultivation is 95.7 acres per square mile, and the crops embrace wheat, barley, corn, potatoes, and fruits of several kinds; lumbering is also one of the chief industries. The town of Santa Cruz is one of the great summer resorts for the people of this coast.

Transportation facilities are abundantly afforded by the vessels of the Pacific Coast Steamship Company that touch at numerous wharves on the coast; also by the South Pacific railroad and the Santa Cruz branch of the Southern Pacific railroad, which passes through the county to San Francisco.

MONTEREY.

Population: 11,302.

Area: 3,520 square miles.—Coast Range mountains, 2,420 square miles; Salinas valley, 700 square miles; other valleys, 400 square miles.

Tilled lands: 168,862 acres.—Area planted in wheat, 69,022 acres; in corn, 488 acres; in oats, 3,363 acres; in barley, 35,426 acres; in vineyards, 10 acres.

Monterey county is divided into valley and mountain regions by two branches of the Coast range, which extend northwestward through almost its entire length. The Gabilan range separates the county from San Benito, while the Santa Lucia range of almost unbroken, lofty mountains extends along the coast, separated from the former range by a broad valley watered by the Salinas river. This river (the most important of this region) rises in San Luis Obispo county and flows northwestward for nearly 200 miles to the bay of Monterey. The Pajaro, in the northern part of the county, flows westward, also into the bay, but is not a long stream.

The Santa Lucia mountains are in places heavily timbered on their lower slopes and in the cañons with Monterey pine, cypress, and redwood. The Gabilan mountains of the east are low and rounded for 18 miles southward from the Pajaro river, and are timbered; but for the next 30 miles, reaching to San Lorenzo, they are high and rough, again sinking to a range of low and rolling hills at the county limit. The range contains much limestone, and among the hills there are a number of small valleys.

The most important agricultural region of the county, although not the largest, is the Pajaro valley, on the northern border, which has a length of about 10 miles and a width of 6 or 8 miles, extending into Santa Clara county on the east and Santa Cruz on the north. Its surface is quite level, and embraces three varieties of soils: *dark loam land* of the plains, well adapted to wheat and barley; *adobe lands*, comprising one-third of the valley or bottoms of Pajaro river, and lying several feet below the plains; and *clayey loams*, comprising the rest of the river lands, and known as the sugar-beet soils. The valley is bounded on either side by a range of smoothly rounded hills, those on the south reaching to within 1 mile of Pajaro station, and being too steep for cultivation. The western part of this southern range consists of sandy and untimbered hillocks, while the eastern is more broken, better timbered, and has an abundant growth of white sage. The small valleys or hollows among these hills are mostly swampy, with either willow or tule, and often hold small lakes or ponds of water. This region of hills is several miles in width, and separates Pajaro valley from that of Salinas river on the south.

The Salinas valley, traversed by the river of that name, and the largest in the county, reaches from the bay of Monterey southeastward between the two mountain chains toward San Luis Obispo county for a distance of 90 miles, where it is very narrow and considerably elevated above the sea. The width varies for the first 50 miles from the coast from 12 to 8 miles, gradually rising inland. The valley presents a terraced and almost treeless plain, the only growth being some live-oak on the northeast and sycamores on the streams. It is described in detail on page 48. Near the upper end of the valley, within the county, are several small valleys, connecting with it or separated by narrow and low hills. *Long valley* is about 10 miles long and half a mile wide, and is partly cultivated. Its soil is an adobe, covered partly with bunch-grass, and the hills bordering it are low, rounded, and treeless, and contain much limestone. *Peach Tree valley*, separated from the last by a range of hills some 300 feet high and timbered with some oak and pine, is 22 miles long and three-fourths of a mile wide, and has, except over an extent of 5 or 6 miles at the lower end, a scattering growth of white oaks. Its soil is a dark loam, deep and rich. The Coast range, on the northeast, rises some 1,600 feet above the valley.

The arable land along the coast for about 15 miles south Carmel of bay is nowhere more than one-fourth of a mile wide. *Carmel valley* is parallel to and lies west of Salinas valley, and its lower foot-hills afford very good pasturage. Comparatively little of the county is under cultivation, the average being 48 acres per square mile. These lands, however, are mostly confined to Pajaro valley, and are planted in small grain, potatoes, etc. Experiments have been made with cotton, but after growing about 12 inches high and blooming the plant suddenly died. The town of Monterey, on the bay of the same name, is the most popular summer resort of the coast.

A railroad from Soledad and Monterey northward to San Francisco affords transportation facilities to the greater part of the valley portion of the county.

ABSTRACT FROM A DESCRIPTION OF CARMEL VALLEY BY ED. BERWICK.

Carmel is a narrow valley lying east and west parallel to Salinas valley. The river drains a scope of country perhaps 30 miles by 5. The mountains in many places are abrupt, rocky, and brush covered; in others, gently rolling and affording good pasturage. Wild oats, alfilerilla, with various kinds of bunch-grass, form the best natural pasturage. The trees most common are the redwood in the cañons, Monterey pine, and cypress; more inland, live oak, white oak, soft maple, buckeye, sycamore; on the creeks, black and red willow and Oregon alder. Poison-oak and southern wood abound. The soil is liable to gully in winter, and the river deposits the soil where the current runs slowly. There is scarcely any level land of more than half a mile in width, as the valley slopes toward the river from either side. There are occasionally small mesa lands, the soil of which is more gravelly than that of the valley, which is a sandy loam resting on a subsoil of coarse sand.

SAN BENITO.

Population: 5,584.

Area: 990 square miles.—Coast Range mountains, 875 square miles; valleys, 115 square miles.

Tilled lands: 90,590 acres.—Area planted in wheat, 32,223 acres; in corn, 299 acres; in oats, 41 acres; in barley, 10,469 acres; in vineyards, 62 acres.

San Benito is a long and narrow county. Its northeast and southwest boundary-lines lie respectively on the summit of two branches of the Coast range (viz: the Gabilan and the inner Coast range), whence the surface slopes abruptly to the valley of the San Benito river, which flows northwestward through the middle of the county and unites with the Pajaro river. A few small streams, of little importance, are tributary to the San Benito.

The lands suitable for cultivation comprise but a small portion of the county area, and lie chiefly on the northwest, forming the southern end of *Santa Clara valley* to Los Pinos, and are drained by the San Benito and Tres Pinos rivers. This valley land is said to embrace about 25,000 acres of light sandy loam, 34,300 acres of black sandy loam or adobe, the valley land proper, and 46,000 acres of what is termed second-class land, partly sandy loam and partly adobe, lying on the foot-hills. In addition, there is a large amount of hill pasture land.

The lower part of this valley, in a "strip reaching from Pajaro river to within 3 miles of Hollister, is a low, flat, wet, partly tule land, with a black soil, used entirely for pasturage".

The valley is from 10 to 12 miles wide below, but a few miles southeast from Hollister it terminates in a kind of rolling bench-land, extending across the valley, and known as *Poverty hill* or *Hollister valley*. This Poverty hill region is treeless, its elevations being adobe in character, and in the depressions a sandy loam covers the adobe. At about 4 feet depth the earth is charged with alkali. Still southeastward the valley becomes very narrow and elevated, and to its source it is rarely one-half a mile wide, and often but a few rods. It is here very much cut up, and is almost wholly occupied by the San Benito river. A few white oaks in the valley and live oaks near the hills, with occasional groups of cottonwood on the river, comprise the only timber. The soil of the valley is yellowish and silty; that of the hill-sides usually an adobe, and scarcely under cultivation. The hills bordering the valley are but thinly covered with a scrub growth of oaks. *Bitter Water valley*, on the south, a continuation of Peach Tree valley, of Monterey county, is said to be 7 miles long and from three-fourths to one mile in width. This valley is treeless, and the hills that border it have a scanty oak growth. Its soil is a yellowish and stiff clay loam, and is tilled with some difficulty, except when moist.

Dry Lake valley or basin, about 4 miles long, has a dark clayey loam soil, partly timbered on both hills and in the valley with oaks, and is thickly settled.

Santa Ana valley, lying eastward of Hollister, has an area of about 15 square miles. Its soil is a dark gravelly loam, underlaid by adobe, and partly covered with scrubby white oak. This valley opens out into San Benito valley, and with it is very generally under cultivation in the cereals, hay, potatoes, etc.

The first-class or valley lands of the county are said to yield from 30 to 40 bushels of wheat per acre, the higher or second-class lands from 20 to 30, while the rolling hill lands produce from 15 to 20 bushels per acre.

The average of tilled lands for the county at large is 91.5 acres per square mile; but, as already stated, the entire acreage is confined almost exclusively to the northern part of San Benito valley, where the average is much higher. The Southern Pacific railroad affords transportation facilities to and from San Francisco.

FRESNO.

(See "Great valley region".)

MERCED.

(See "Great valley region".

SAN LUIS OBISPO.

Population: 9,142.

Area: 3,460 square miles.—Coast Range mountains, 2,370 square miles; valleys 1,090 square miles.

Tilled lands: 177,598 acres.—Area planted in wheat, 10,618 acres; in corn, 458 acres; in oats, 937 acres; in barley, 9,658 acres; in vineyards, 56 acres.

San Luis Obispo county is bounded on the south by the Santa Maria river, which flows westward, reaching the ocean through the Guadalupe lagoon, the eastern boundary lying along the summit of the Coast Range, which borders the great San Joaquin valley on the west. The county is divided diagonally into two valley regions by the Santa Lucia range, which enters on the northwest, passes through and unites with the Coast Range in the southeast corner, and has elevations varying from 3,000 feet to that of low hills.

The eastern valley region presents a series of low, rolling hills, interspersed with valleys watered by Salinas river and San Juan creek and other streams, all of which flow northwestward. During the summer months the waters of these streams do not flow continuously in their channels, but rise and sink alternately at short distances. Salinas valley, the chief valley of the region, is about 9 miles wide, and has an elevation of about 1,000 feet above the sea. The surface rises on the southeast into a level plateau some 300 feet above the valley proper and soon terminates against the mountains.

Paso Robles, noted for its medicinal springs, is situated in a plain about 10 square miles in the lower part of the valley, surrounded by a live-oak grove. North of this locality there is but little timber, either in the valley or on the hills, except southward, where the hills are timbered with considerable oak, and, near the mountains, with pine. Manzanita is also abundant in many localities, and chamisal occurs on the hills north of Paso Robles. The soil along the streams is mostly a dark loam covered with alfilerilla and burr clover; that of the uplands is generally a stiff clayey loam, more or less gravelly, easily tilled, interspersed with some adobe tracts, and is covered with alfilerilla, burr clover, bunch-grass, and wild oats, the latter chiefly on the higher hills. There is some loam land on the Santa Margarita and San José lying contiguous to the Santa Lucia mountains, while the lands of the Salinas plains are red in color. The valley of Estrella creek is rolling and partly timbered with very scattering scrub oaks. Its soil is a dark gravelly loam, with some adobe.

The lands of the higher plateau of the southeast, or Carisa plains, are very level, bounded on either side by high and abrupt mountains, and have mostly adobe lands, covered with grasses and devoted to grazing purposes. The entire eastern valley is chiefly a sheep and cattle range, though cereals are successfully grown near the foot of the Santa Lucia mountains; and "fruit trees have done well in some cases, and the grape thrives to an extraordinary degree".

The coast valleys on the west of the Santa Lucia mountains are narrow on the north, but toward the south widen out to many miles, and are rolling and interspersed with many high ridges and hills. The San Luis Obispo plain has an elevation of about 150 feet above the sea. The Osos, Laguna, and Chorro valleys run parallel with

each other as far south as what is known as the mission lands around the city of San Luis Obispo. Thence the Corral de Piedra valley continues south until it intersects the valley of the Arroyo Grande. Beyond this is the Nipomo (more properly an elevated plain) and that portion of the Santa Maria valley, situated on the right bank of the Santa Maria or Cuyamas river, which forms the southern boundary of the county. This region is watered by numerous streams flowing from the Santa Lucia mountains to the ocean, which are bordered with a timber growth of willows, cottonwood, sycamore, laurel, and live-oaks. The hills are sparsely timbered with sage-brush and chamisal. A chain of highlands or hills line the coast, rising in many places directly from the water's edge. These begin just south of Santa Rosa creek and extend to within a few miles of Cayucos, where a break occurs. Immediately south of Morro or Estero bay they again follow the coast line to within a few miles of the southern boundary of the county. The northern section, lying between Santa Rosa creek and Cayucos, does not exceed 250 feet in height, but south of the Morro they attain in places an altitude of 2,000 feet, protecting the valleys from the too direct and unintermitting influence of the sea wind. The protection thus afforded by this natural barrier enables the farmer to raise fine grades of wheat, the most valuable of all the cereals.

The coast region is the chief farming portion of the county. Its lands are of three grades: *Dark loams of the bottoms*, suitable for vegetables, etc.; *dark or reddish sandy loams of the valleys*, resting on heavy clays, and *lighter and gravelly soils* of the hills and rougher portions of the valley. The crops of this region comprise wheat, barley, corn, potatoes, and several varieties of fruits and grapes. In the summer months the prevailing northwest winds occasionally blow with some violence immediately along the coast and through the valleys which open fairly to the sea, and drive through them great fog drifts, which rise from the ocean in the evenings and settle down at night close to the earth. But at sunrise the fog rises and, rolling up the mountain sides, disappears. The valleys lying closer to the western slope of the Santa Lucia range are comparatively exempt from these winds and fogs.

The lands of Corral de Piedra valley have a heavy loam soil, with streaks of adobe, and are said to yield 40 bushels of wheat per acre.

The average of lands under cultivation in the county is 51.3 acres per square mile, while the average of population is but 2.6 persons per square mile. Dairying and cheese-making is extensively carried on in the county.

A short line of railroad connects San Luis Obispo with Port Harford, where the steamers of the Pacific Coast Steamship Company touch regularly.

ABSTRACT FROM A DESCRIPTION OF THE WESTERN PART OF THE COUNTY BY D. F. NEWSOM, OF NEWSOM SPRINGS.

The west side of the Santa Lucia mountains is well watered, and is a succession of valleys, with bottom and table-lands very productive, and a great part susceptible of irrigation, from which two and sometimes more crops can be raised in one year. It is estimated that 30,800 acres of first-class lands on this side of the mountain can be irrigated by co-operation among the farmers interested and without any very great expense. The larger valleys are liable to frosts from October to April, while the small cañons in the hills are in a great measure exempt from frosts. Dairying and farming are the chief occupations on the coast side of the mountains, and stock raising on the east side, but this will eventually be a wheat-growing section.

SANTA BARBARA.

Population: 9,513.

Area: 2,200 square miles.—Coast Range mountains, 1,900 square miles; valleys, 300 square miles.

Tilled lands: 108,749 acres.—Area planted in wheat, 18,492 acres; in corn, 3,167 acres; in oats, 24 acres; in barley, 13,598 acres; in vineyards, 77 acres.

Santa Barbara county is hilly and mountainous, a large proportion being too high and broken for cultivation. The San Rafael mountains cover more than one-third of the county on the northeast, while on the southeast the Santa Inez rises as a narrow range parallel with the coast to an altitude of 3,000 or 4,000 feet.

The western coast line of the county has a north and south trend to point Concepcion, where it turns abruptly to the east. Lying parallel with this latter portion, and at a distance of about 30 miles, are a number of islands, also mountainous, rising as high as 1,500 feet above the sea. The county is watered by the Santa Maria river on the north and by the Santa Inez on the south, both flowing westward into the ocean and bordered by important valleys.

Santa Maria valley is about 30 miles long and 10 wide, and lies partly in San Luis Obispo county. The soil is sandy, dotted over with oaks, and has a vegetation of clover and alfilerilla. This valley is chiefly devoted to grazing purposes. The Santa Inez valley is about 30 miles long, and averages 2 miles in width, the width in both this and Santa Maria valley being greatest some 15 miles from the coast, which they reach through narrow cañons. The valley soil is chiefly a loam, and was originally timbered with oaks. The surface presents a series of terraces of 25, 45, and 95 feet elevation, respectively, above the river, and is timbered partly with oaks and sycamores. The valley is chiefly used for pasturage. The Santa Inez range of mountains lies on the south, separating this valley from the coast valley, in which the county-seat is situated. This range is steep and rugged, and is covered with chamisal brush; but there are some oaks in sheltered places. The coast valley, extending from Gaviota pass, east of point Concepcion, to the Ventura county-line, and varying in width from 2 to about 6 miles in the central part, has a rise of 300 feet inland, and is divided into an upper and lower valley, the former being known as the Santa Barbara valley, or plain, from the town of that name, from whose southern edge the valley slopes to the coast, forming the lower valley to the eastward. West of the town, and reaching to the Gaviota pass, the coast line forms a terrace about 80 feet high, sloping landward, and inclosing between it and the mountains the upper valley. The soil of the valley is a sandy loam, and is largely under cultivation in grain. Irrigation is necessary in the higher lands only.

Carpenteria valley, lying east of Santa Barbara, is also a coast valley opening south, and surrounded on the other sides by high mountains, its surface gradually rising to the bald hills. The valley was originally well timbered with live-oak and some sycamore and walnut. It is well watered, with small streams, in whose alluvial lands strawberries and other fruits are raised. The crops are corn, beans, and potatoes. The foot-hills and mesa lands bear naturally the wild oat.

On the coast from point Concepcion northward to point Purisima lies the Lompoc valley, its length being about 37 miles. This valley is thought to contain about 35,000 acres of arable land, and has been mostly devoted to pasturage.

The Los Alamos valley, lying along the arroyo of that name, reaches from the mountains to the coast and between the Lompoc and Santa Maria valleys, its length being about 40 miles and its greatest width 2 miles. The largest portion of this valley lies about 25 miles from the coast, and has a soil varying from an adobe to sandy loam, partly under cultivation. On either side are low rolling hills and connecting valleys.

The lands under cultivation in the county average 49.4 acres per square mile, but, omitting the general mountain districts from the area, we find the average to be about 100 acres per square mile. The county is connected with San Francisco by the Pacific Coast steamship lines.

KERN.

(See "Great valley region".)

TULARE.

(See "Great valley region".)

VENTURA.

Population: 5,073.

Area: 1,690 square miles.—Coast Range mountains, 1,520 square miles; valleys, 170 square miles.

Tilled lands: 81,107 acres.—Area planted in wheat, 8,479 acres; in corn, 9,121 acres; in oats, 40 acres; in barley, 28,171 acres; in vineyards, 134 acres.

Ventura county is mostly hilly and mountainous, the northern half rising to an elevation of more than 4,000 feet above the sea and forming a part of the Coast range. The southern part, while hilly and broken with mountain ridges, is interspersed with numerous valleys, which are well watered and afford fine farming lands.

The Santa Clara and Buenaventura rivers are the chief streams of the county, both rising among the mountains and flowing to the ocean. The former is the longest, and is bordered throughout its length by a valley which, from near Newhall, in Los Angeles county, varies in width from a mile and less as far as Santa Paula, then widens gradually, until within about 12 miles from the coast it suddenly expands to about 16 miles on the coast. This is the largest valley region of the county, and contains considerable land under cultivation in wheat, barley, corn, and beans. Above Santa Paula the soil is generally sandy; below, to the coast, it is dark-gray silty loam of great depth and remarkable for its retention of moisture near the surface. Saticoy plain, or delta of the Santa Clara river, is noted for its high production of corn and beans, a large part of the state's marketable supply being grown here. Hogs are also extensively raised.

Buenaventura river is bordered by a valley about 20 miles long and one-fourth of a mile wide, which has sandy soils and is largely under cultivation. The mountain valleys usually have an adobe soil, with much vegetable matter. Those valleys whose elevation is less than 2,000 feet are partly under cultivation in wheat and other grain. Of these the Ojai is most noted, and lies along the Canada Larga. It has an elevation of from 800 to 1,000 feet, and is divided into an upper and lower valley. This valley is about 6 miles long and about 1½ miles wide, and is largely timbered with live and white oaks and some cottonwood. The soil of upper Ojai is a rich black adobe, yielding 50 or 60 bushels of wheat per acre, while that of the lower valley is a reddish-gray, sandy loam, much under cultivation.

The Sulphur Mountain range, between Ojai and Santa Clara valleys, is remarkable for its extensive deposits of asphaltum, which substance oozes out at certain levels throughout the range, and at times forms bubbling springs and flowing streams of thick petroleum. In the Sespe valley a flowing petroleum well of high production has been obtained, and numerous others of moderate yield exist in other parts of the county.

The soil of the mountains is a reddish loam, largely timbered with fir and pine. Cotton has been successfully raised in this county, but only in very small patches and with extra attention, it being too much exposed to trade winds and fogs from the ocean.

The county is connected with San Francisco by the Pacific Coast line of steamships.

COAST RANGE REGION.

(North of San Pablo bay.)

(This region embraces the following counties and parts of counties: Marin, Sonoma, Napa, Solano,* Yolo,* Lake, Colusa,* Mendocino, Tehama,* Shasta,* Trinity, Humboldt, Siskiyou,* and Del Norte.)

MARIN.

Population: 11,324.

Area: 580 square miles.—Nearly all Coast Range mountains.

Tilled lands: 21,357 acres.—Area planted in wheat, 2,603 acres; in oats, 1,031 acres; in barley, 1,499 acres; in vineyards, 40 acres.

Marin county is bounded on the west by the ocean, and on the east, in part, by San Francisco and San Pablo bays, the Golden Gate separating it from the county of San Francisco on the south. A range of mountains passes through it in a northwest direction, mount Tamalpais, with an altitude of 2,597 feet, being the highest point. The rest of the county embraces high hills and small valleys, watered by numerous streams, flowing chiefly to the bay on

the east. Both the east and the west shores are abrupt and deeply indented by bays, of which Drake's and Tomales are the chief, that of Tomales, on the northwest, being the largest, reaching inland for 16 miles with a width of 2 or 3 miles, and occupying a valley between two or more mountain ridges. Point Reyes is a narrow, prominent headland. There is but little level land in the county, the valleys along the streams being quite narrow, and the hills approaching close to the shore lines. The mountains were originally timbered with redwood and pine, but the greater part has been cut away; the lower hills and many of the valleys have a sparse growth of oak. The soil of the hills and rolling lands is usually a black adobe, more or less gravelly; that of the valleys a dark sandy loam, rich and productive.

There is a large area of salt marsh along the eastern shore, some of which has been reclaimed by levees, and is now termed meadow lands. Dairying is the chief occupation of the people of the county, for which the valleys and hills, with their abundant vegetation, afford excellent pasturage. The lands under cultivation average 36.8 acres per square mile for the entire county.

Under the lee of mount Tamalpais, near San Rafael, the climate of San Francisco bay is sufficiently tempered to allow the grape and the fig to ripen regularly.

Transportation facilities are furnished by two lines of railroad, which connect by steamer with San Francisco. San Rafael being practically a residence suburb of the former city, is much frequented on account of its milder climate.

SONOMA.

Population: 25,926.

Area: 1,520 square miles.—Coast Range mountains, 1,170 square miles (redwood lands, 300 square miles); valleys, 350 square miles; tule lands, some.

Tilled lands: 178,954 acres.—Area planted in wheat, 39,820 acres; in corn, 5,961 acres; in oats, 2,615 acres; in barley, 11,126 acres; in vineyards, 8,540 acres.

The surface of Sonoma county is hilly and mountainous, interspersed with numerous fertile and well-watered valleys. The principal stream is Russian river, which, entering the county from the north, flows southeastward for a distance of about 25 miles, and then turns westward to the coast. It has many small tributaries, which drain the greater part of the county, each bordered by narrow valleys. The northern part of this county is the most mountainous, some of the spurs of the Coast range being from 2,500 to 3,000 feet high. Many of the mountains and some of the lower hills are covered with a growth of redwood, pine, and fir; but in some of the valleys, and on the northeastern slopes of the hills, there is a scattered growth of oak, madrona, large manzanita, buckeye, etc., with some willow and sycamore along the streams. The southern part, "from the coast inland to Santa Rosa valley, is a succession of low, well-watered valleys, bare of trees, and covered by a good depth of soil and a rich sward of natural grasses, which are kept green for most of the year by the sea mists which roll over them during the dry summer months." The low mountain ridges eastward to Napa county are partly covered with a chaparral of chamisal, manzanita, and other growths.

The principal valleys are Russian river and Santa Rosa valleys on the north and central portions of the county, and Petaluma and Sonoma valleys on the south, the latter being separated by low mountains. The first two, with Petaluma valley, form a central valley through the county from north to south, through which the San Francisco and North Pacific railroad runs to Cloverdale, a distance of 50 miles. *Russian River valley* is narrow, and for 15 miles from its mouth was originally covered with a heavy growth of redwood, but otherwise, with the exception of scattered groves of oaks, it is almost destitute of trees. Its lands are alluvial loams, very rich and productive. The valley of *Santa Rosa* is about 10 miles long and 6 wide, bordered by low mountains on the west and a higher range on the east, and is generally under cultivation. The county-seat, located here, is surrounded with oak and other trees. *Bennett valley*, 8 miles long and 3 miles wide, unites with this valley near the town, and its soil varies from a red loam to dark adobe, and is largely under cultivation in grapes. The timber growth of the valley and the adjoining hills is white, black, and live oaks, madrona, etc. *Petaluma valley*, on the south, is about 20 miles long and 3 miles wide, and its soils are rich and moist and well adapted to the cultivation of fruit, corn, and wheat. There is much salt marsh bordering the bay on the south, the tract being estimated to contain about 17,000 acres; but it is partly reclaimed and under cultivation, two or three years being required before it is made ready for planting.

Sonoma valley, to the eastward of Petaluma, and separated by a mountain range, reaches about 16 miles northward from San Pablo bay, and has a width of about 2 miles. At its northern end it forks, passing into Guillocos valley on the east, while northward it connects with Santa Rosa valley through Bennett's valley. Its southern portion is occupied by marsh and tule lands to within a few miles of the town of Sonoma, the rest of the valley having a light gravelly loam soil, with water not far below the surface. It is almost exclusively devoted to the cultivation of the grape and fruits, transportation facilities being afforded by the Sonoma Valley narrow-gauge railroad. There are valleys of greater or less extent among the hills in the western part of the county, two of considerable size extending through this region—one, the valley of the Estero Americano, running from west to east through Bodega township, terminating at Tomales bay; the other, Green valley, extending from north to south, the stream from which the valley takes its name emptying into Russian river. Green valley is almost exclusively devoted to fruit culture.

The land of the county is classified by the assessor into four grades. The first and least valuable grade is the mountain, brushy, and bare hill land, estimated at 300,000 acres, and utilized only for pasturage. The second grade, timber lands and hillside pasturage, is estimated at 200,000 acres. The third grade is mainly rolling lands, denuded of timber, lying along or near the sea-coast, used for dairy purposes, and estimated at 200,000 acres. The fourth grade, rich bottom lands, is estimated at about 150,000 acres.

Along the mountain and hill sides, some 300 or 400 feet above the valley, there is a "thermal belt" elevated above frost limits, where many tender fruits may be successfully grown.

The North Pacific Coast narrow-gauge railroad runs through the region to Russian river, affording convenient transportation. There are also good shipping points by sea from Tomales and Bodega bays. The Sonoma valley is connected with San Francisco by rail and steamers.

ABSTRACT FROM A DESCRIPTION OF BENNETT VALLEY BY G. N. WHITAKER, OF SANTA ROSA.

Bennett valley possesses all the features of other valleys of the county. It has a length of 8 miles and an average width of 3 miles, and joins Santa Rosa valley near the town of that name, extending back in a southeast course. The northwest half of the valley is a fine farming country; the southeast half lies quite elevated in the thermal belt, and is well adapted to the culture of fruits, grapes being a specialty. There is a high range of hills west of and parallel with this valley, which is fertile to the summit; but that on the opposite side is not so sloping or so fertile. Both valley and hills have a natural growth of wild oats, bunch grass, etc., and a timber growth of white and live oaks, laurel, madrona, and some spruce pine and redwood. The soil of the valley varies from dark and light to red sandy loams and adobe, and in depth from 6 inches to 5 or 6 feet, and is underlaid by soft shaly rock and yellow clay. The chief crops are wheat, barley, and grapes, and when fresh the lands have yielded from 30 to 40 bushels of wheat and from 30 to 50 bushels of oats and barley per acre.

NAPA.

Population: 13,235.

Area: 840 square miles.—Coast Range mountains, 620 square miles; Napa valley, 145 square miles; other valleys, 40 square miles; tule lands, 35 square miles.

Tilled lands: 81,045 acres.—Area planted in wheat, 33,653 acres; in corn, 1,664 acres; in oats, 1,014 acres; in barley, 5,753 acres; in vineyards, 6,671 acres.

Napa county, lying in the eastern part of the Coast range, is a region of mountains, hills, and valleys, one-half of its surface, however, being suitable for cultivation. The mountains on the north, culminating in the volcanic peak of Saint Helena, have their highest elevation within the county, and are heavily timbered with fir, pine, and cedar. To the southward they diminish in height, occasionally flattening out into timbered plateaus 1,500 or 2,000 feet above the sea, and well adapted to cultivation, but in the southern part of the county they sink into low, grassy, and broken hills. The eastern, western, and northern boundary-lines rest on the summit of the mountains, while the southern is formed in part by the shore of San Pablo bay. The principal topographical feature of the county is *Napa valley*, which occupies centrally a northern and southern position, reaching from the bay 35 miles inland, and having an average width of 4 or 5 miles, except in the northern part (above Yountville), which is only about 1 mile wide. The general surface has a gentle slope southward to the tule lands, and is watered by Napa creek, which, though small, is a tide-water stream, navigable to Napa City for small craft, and is the largest in the county. Along the lower portion of Napa slough there is quite an extensive belt of tule lands, some of which have been successfully reclaimed, proving very productive. The soil of the upper valley is a gravelly loam, while that of the southern or lower is a sandy loam, rich and productive, and largely under cultivation.

Knight's valley, on the north, forms a connecting link between Napa valley and that of Russian river, in Sonoma county, and is about 7 miles long and 2 miles wide, surrounded by high and heavily timbered mountains. The rest of the county consists of a series of mountain ridges and narrow valleys watered by small streams, those on the northeast being included in the basin of Putah creek. "East of Napa valley is Conn valley, half a mile wide by 6 miles long. South of this is Wooden valley, 3 miles long by 1 mile wide. North and east of Chiles is Pope valley, 8 miles long by 1 mile wide. South of Pope is Capelle valley, 2 miles long and half a mile wide. East of Pope is Berryessa valley, 7 miles long by 1½ miles wide, and bordered on the east by the high range of mountains that forms the boundary-line of the county (*California As It Is*).

The *Berryessa valley* is an agricultural region, and is largely under cultivation. It is surrounded at first by low hills, and further back by high mountains, timbered with pine, fir, and some cedar. The lower ranges are covered with thickets of hazel, buckeye, California bay and lilac, oak and ash, and an undergrowth of grasses, wild clover, etc. The valley is dotted with oaks, and is devoted to wheat, which yields about 30 bushels per acre; the lower hills are planted in vineyards. Conn valley is also planted in vines and wheat; but at the head there is a plateau of rolling country heavily timbered with pine and black oak.

The assessor of the county has estimated that there are 69,051 acres of the best valley land, 38,287 acres of best hill land and poorest valley land, suitable for grazing, 45,891 acres of hill land adjoining the grazing lands, and 31,711 acres of the poorest quality of hill lands.

Cotton has been grown in Napa county at an elevation of 1,500 feet above sea-level.

Grape culture is one of the chief industries of the county. The vineyards begin a short distance below Napa, city and extend either side up into the foot-hills. As we go northward they increase, until in Saint Helena valley, separated from lower Napa valley proper by a narrow pass near Yountville, we find one of the great wine-making centers of the state, and the point where the grape production per acre has been as high as 13 tons, the entire valley and a portion of the slopes, as well as the adjoining plateaus, being occupied by vineyards, wine-cellars, etc.

Transportation facilities are afforded by the Napa branch of the California Pacific railroad, which connects at Vallejo with steamers for San Francisco.

ABSTRACT FROM A DESCRIPTION OF LANDS OF HOWELL MOUNTAIN REGION, IN THE NORTHERN PART OF THE COUNTY, BY JOHN MAVITY, OF SAINT HELENA.

The summit of Howell mountain is a broad plateau of about 8,000 acres, or rather a plain broken up into small elevations and little vales, the hills varying in height from 100 to 200 feet. The higher points are generally very rocky, with slopes of reddish soil. The plateau has an elevation of from 1,600 to 1,800 feet above the sea, and is covered with a growth of black oak (or what is here known as mountain oak), white oak, yellow pine, nut pine, a very little fir, and manzanita. The land has a red and somewhat gravelly clay soil, well adapted to the growth of fruit trees and grape-vines.

SOLANO.

(See "Great valley region".)

YOLO.

(See "Great valley region".)

LAKE.

Population: 6,596.

Area: 1,100 square miles.—Coast Range mountains, 1,000 square miles; valleys, 100 square miles.

Tilled lands: 38,564 acres.—Area planted in wheat, 8,296 acres; in corn, 755 acres; in oats, 352 acres; in barley, 4,551 acres; in vineyards, 54 acres.

Lake county is included between the summits of two branches of the Coast range, which unite at mount Saint John's on the north, and have an altitude of from 3,000 to 4,000 feet. The valley thus formed has a length of about 40 miles and a width of nearly 15 miles, the sides of which are bordered "by narrow ridges of broken mountains, separated by deep gorges and narrow cañons, covered with timber, underbrush, wild oats, and wild grapes". Clear lake is a central feature of the county, covering an area of nearly one-third of the valley, and has an altitude of over 1,000 feet above the sea. Its length is about 25 miles, while its width varies from 10 miles on the north to 2 miles on the south, being divided into what are known as *upper* and *lower* lakes by Uncle Sam mountain, which reaches into it and rises abruptly from the water's edge to an elevation of about 2,500 feet. The lake receives the greater portion of the drainage of the county, and has for its outlet Cache creek, which flows from the southern point eastward through Yolo county. There are no large streams in the county. On the extreme north, and separated from the valley by a range of high mountains, are the headwaters of Elk river, which flows northwestward through Mendocino county.

The mountains are largely timbered with pine, the sugar pine occurring in extensive forests on the north; the hills have an abundant growth of oak and fir. A feature of the southern mountains are the extensive tracts of the chamisal brush, which has been found valuable for sheep.

The farming portion of the county is embraced within the central valley region, lying on the west of Clear lake and among the hills along the streams. The eastern shore of the lake is mountainous, but on the west and north of Uncle Sam mountain there is much level or undulating alluvial loam land from 2 to 5 miles in width, reaching northward above the head of the lake and southwestward for 15 miles from Lakeport. It is dotted over with oaks and willow. Other valleys are also partially timbered with white oak, and have red sandy and gravelly soils. Coyote valley is 10 miles long and 3 miles wide, and long valley 6 miles long and 2 miles wide. Scott's valley has a sandy loam soil, and is said to yield 8 tons of potatoes, 30 bushels of wheat, or 50 bushels of corn per acre.

The crops of the county embrace chiefly wheat and barley, but from the luxuriance of the growth of the native grape-vine it is presumed that this county will hereafter become an important grape-growing district.

Cloverdale, in Sonoma county, on the San Francisco and North Pacific railroad, is the shipping point for the north and middle portions of the county, and Calistoga, in Napa county, on the California Pacific railroad, receives freight for and from the southern part.

COLUSA.

(See "Great valley region".)

MENDOCINO.

Population: 12,800.

Area: 3,780 square miles.—Coast Range mountains, 3,655 square miles (redwood lands, 745 square miles); valleys, about 125 square miles.

Tilled lands: 58,164 acres.—Area planted in wheat, 8,899 acres; in corn, 884 acres; in oats, 2,843 acres; in barley, 3,544 acres; in vineyards, 77 acres.

Mendocino is a mountainous coast county, its prominent topographical feature being two chains of Coast range mountains running nearly parallel and separated by the valleys of Eel and Russian rivers. The headwaters of these streams rise near the center of the county, on opposite sides of a ridge lying east and west, Eel river flowing thence northward through Humboldt county to the coast, receiving the waters of many tributaries along its course, while the Russian river flows southward through Sonoma county and drains a smaller basin. Many small streams flow from the western Coast range of mountains directly and independently into the sea, affording facilities for floating logs, etc., from the mountains and adjoining valleys to the coast.

The Coast range is covered from one end of the county to the other by a dense growth of redwood, pine, fir, oak, and madrona, with some dogwood, maple, and bay. The tops of the highest peaks, which rise to an elevation of some 6,000 feet, are bare of timber and rugged, and covered only with chaparral. This region is almost exclusively devoted to lumbering. The eastern range of mountains is mostly treeless and is known as the Bald Hills. There is, however, an abundant growth of clover, wild oats, etc., and the region is largely used as a sheep pasture.

The lands of the county suitable for cultivation have been estimated to cover about 900,000 acres, and lie chiefly in the valleys adjoining the two rivers and their larger tributaries. Two hundred thousand acres more are good grazing lands, while the rest of the county area is rugged and mountainous.

Lying between the main ranges of mountains are several extensive and fertile valleys within the limits of this county. In these valleys most of the farming population resides, and here three-fourths of the grain, fruits, and vegetables produced in the county are raised. Commencing with Ukiah, a part of the main Russian River valley, and which extends south 15 miles into Sonoma county, we have adjoining it on the north *Coyote valley*, 3 miles long by 1¼ miles wide, connecting with *Potter's valley*, 6 miles long and 2 miles wide Twenty miles north of Ukiah is *Little Lake valley*, beyond which to the north is *Sherwood's valley*, and 9 miles farther on *Long valley*, all containing a considerable area of good land. *Round valley*, 60 miles from Ukiah, lies in the northern part of the county, extending into Humboldt county.—*Natural Wealth of California.*

Sherwood valley, at an elevation of 2,500 feet, is 5 miles long and 1 mile wide. The soil of this valley is mostly a dark sandy loam, and is well adapted to the growth of cereals and fruits.

Shipments of supplies to and from the southern part of the county are made by wagon to Cloverdale, in Sonoma county, and thence by railroad to San Francisco. Coasting vessels carry on an extensive trade between the coast towns and the city of San Francisco.

TEHAMA.

(See "Lower foot-hill region".)

SHASTA.

(See "Lower foot-hill region".)

TRINITY.

Population: 4,999.

Area: 2,490 square miles.—Coast Range mountains, nearly all.

Tilled lands: 4,830 acres.—Area planted in wheat, 1,071 acres; in corn, 30 acres; in oats, 165 acres; in barley, 14 acres; in vineyards, 3 acres.

Trinity, lying east of Mendocino county, is a long and narrow county, whose eastern and northern boundary-lines rest upon the summits of two of the chains of the Coast range, and whose surface is made mountainous and broken by many other spurs and lofty ridges of the same range. It is watered by numerous streams, all having their sources in the county and flowing eventually into the ocean on the west. Trinity river, the largest of these, rises on the northeast in the acute angle formed by the two mountain boundaries, flows southwest for many miles, and then turns sharply to the northwest, receiving in its course the waters of many tributaries. The southern part of the county has but very few streams, and is little else than a mass of high rugged mountains, with some good grazing lands. Some points are said to rise to an elevation of 11,000 feet, and are often covered with snow through the summer months. They are granitic in character, and their sides are cut up into chasms and canoñs. The mountain timber-growth is for the most part pine, spruce, fir, and oak, with maple in the lowlands. The valleys along the streams are very narrow, and afford comparatively little land suitable for cultivation. The entire arable area in the county is estimated to be not more than 15,000 acres, and is mostly confined to the Trinity river and its tributaries, occurring in small tracts and being partly under cultivation. The valleys and foot-hills that often border them are sparsely timbered with oak and pine, while on the streams there is some sycamore, cottonwood, maple, laurel, and ash.

Gold mining is the chief and almost exclusive industry of the county. The crops comprise hay and wheat, for which there is a home market. Supplies are mostly brought by wagon across the mountains from Redding, in the Sacramento valley, on the east.

HUMBOLDT.

Population: 15,512.

Area: 3,750 square miles.—Coast Range mountains, nearly all (redwood lands, 1,000 square miles).

Tilled lands: 69,025 acres.—Area planted in wheat, 3,437 acres; in corn, 624 acres; in oats, 8,817 acres; in barley, 2,629 acres; in vineyards, 10 acres.

Humboldt, a coast county, is very hilly, mountainous, and rugged, and is watered by the Trinity, Mad, Eel, Mattole, and other smaller rivers, all flowing northwestward into the ocean. These rivers are bordered by some narrow valleys, but are not navigable for small sailing vessels for more than a few miles from the sea. From Eureka eastward to the mountains proper, a distance of about 25 miles, the country is hilly and broken. Much of the county is occupied by the outlying spurs and more westerly ranges of the Coast mountains, which, near the coast, are covered with heavy forests of redwood, spruce, and pine. The timber belt, varying in width from 8 to 10 miles, recedes from the coast in some places in this county a distance of several miles, leaving at these points an elevated terrace or sandy beach destitute of timber. The most westerly branch of the Coast range is rugged and broken within the limits of the county, mount Pierce, one of its highest peaks, being 6,000 feet high. The more easterly ridge, forming the boundary between this and Trinity county, also rises in some places to a considerable height, mount Bailey, one of its peaks, being 6,357 feet high. There is much chestnut oak (valuable for tanbark) in this region.

Among the mountains there are small valleys watered by the various streams, but the largest tract of level land lies around Humboldt bay. The timber growth on the streams is willow, alder, cottonwood, maple, ash, and bay, and the soil is chiefly an alluvial loam, deep, dark, and rich. That of Eel river is so black that with its growth of tussock grass it has received the name of "nigger-head" soil. Around the bay and near tide-water there is much overflowed or swamp land, separated from the coast-line by a low sand-hill region covered with a stunted growth of trees. The hills have usually a dark sandy loam soil, and on the east are covered with grasses, clover, and wild oats, affording an excellent grazing country. The hills around Ferndale are covered with the eagle fern, which often grows to a height of 12 feet; and the valley of Mattole, in which the town is situated, is 12 miles long and from 4 to 8 miles wide, and also contains much of this growth.

The lands under cultivation lie chiefly in the river valleys on the western side of the county, the soils of which are dark sandy loams, easily tilled, and produce good crops of oats, barley, potatoes, and pease. Lumbering is the chief industry of this western section. The eastern part of the county is chiefly devoted to stock-grazing. It has been estimated that of the county area there are 921,600 acres of timbered lands, of which 200,000 acres are of madrona, black and white oaks, and laurel, 450,000 acres are adapted to agricultural purposes, and 500,000 acres suitable only for grazing lands.

The county is at present dependent upon coast steamers and vessels for transportation facilities. Humboldt bay, 12 miles long and from 2 to 5 miles wide, is one of the largest harbors on the coast, and is almost landlocked.

SISKIYOU.

(See "Sierra mountain and higher foot-hills region".)

DEL NORTE.

Population: 2,584.

Area: 1,540 square miles.—Coast Range mountains, nearly all (redwood lands, 150 square miles).

Tilled lands: 10,678 acres.—Area planted in wheat, 56 acres; in corn, 42 acres; in oats, 200 acres; in barley, 54 acres; in vineyards, 4 acres.

Del Norte, the extreme northwesterly county of the state, has a mountainous and broken surface, watered on the east by Klamath river, which crosses it in a southwesterly course, and on the west by Snake river and other streams, which flow to the sea. The Siskiyou chain of mountains, having a general though irregular northeast and southwest trend, forms the divide between the two water-sheds, and from this other mountains extend almost at right angles, thus giving to the eastern portion of the county a rugged character. The coast is bordered by a range of hills some 600 feet in altitude, while still inland another range rises to a height of 3,000 feet. Most of the county is well timbered with redwood, fir, spruce, pine, some cedar, hemlock, and myrtle, and there is also a considerable amount of open prairie land. The streams usually have small and narrow valleys, together with swamp and overflowed lands, whose area is estimated at 3,500 acres. The chief industries of the county are dairying, lumbering, and to some extent mining. Comparatively little land is under cultivation, the average being but 6.9 acres per square mile. Steamers and sailing vessels run between Crescent City, the county-seat, and San Francisco.

HIGHER FOOT-HILL (OVER 2,000 FEET) AND SIERRA MOUNTAIN REGIONS.

(Embraces the following counties and parts of counties: Siskiyou, Modoc, Lassen, Shasta,* Tehama,* Plumas, Sierra, Nevada,* Placer,* El Dorado,* Amador,* Alpine, Calaveras,* Tuolumne,* Mariposa,* Mono, Inyo, Fresno,* Tulare,* and Kern.*)

SISKIYOU.

Population: 8,610.

Area: 5,660 square miles.—Sierra mountains, 2,550 square miles; Coast Range mountains, 2,210 square miles; valleys, 900 square miles.

Tilled lands: 50,777 acres.—Area planted in wheat, 6,330 acres; in corn, 112 acres; in oats, 3,268 acres; in barley, 3,598 acres; in vineyard, 10 acres.

Siskiyou, one of the most northern counties of the state, embraces a region of mountains and high valleys and broad plateaus. The Sierra Nevada and Coast ranges meet in this county, the culminating point being mount Shasta, near the southern limit. This celebrated mountain has an elevation of 14,440 feet above the sea, its upper 4,000 feet being covered with snow throughout the year, while its lower 7,000 or 8,000 feet has heavy forests of sugar and pitch pine on all sides but the north, which has only a stunted growth of cedar and oak.

"The Coast range is most picturesque in this county, the summits being very unlike the rounded hills surrounding the bay of San Francisco, for they rise with their rocky formations of granite and slate into rugged and precipitous peaks. The Sierras also consist in great part of rough and rugged buttes, much of the country thus comprising cañons, gorges, ravines, abrupt mountain walls, precipices, and sudden little valleys. This wild country is covered with forests of redwood, fir, and sugar pine" (*California As It Is*). The eastern part of the county is a high plateau of lava beds from 3,000 to 4,000 feet above the sea, interspersed with mountains and volcanic peaks, rising many thousand feet higher. A large part of the county is without drainage; but the Klamath river crosses the northwestern corner from Oregon, receiving from the south the waters from Scott's and the upper part of Shasta valley. In the southern part of Shasta valley the Sacramento river has its source, flowing southward, while on the east of the mountain McCloud river rises, flows southeast into Shasta county, and finally empties into the Sacramento.

The chief agricultural lands of the county are embraced within Shasta and Scott's valleys on the west, though there are a few smaller ones that have some good farming land. *Scott's valley* is 40 miles long and 7 miles wide, and lies between Trinity and Salmon mountains, of the Coast range, which rise to elevations of nearly 6,000 feet, the valley itself being about 3,000 feet. It is largely under cultivation, yielding grain, fruits, and vegetables. Owing to its elevation, the harvests are late, the grain not being reaped until August or September. Frosts are frequent during the spring, and even in the summer months. The weather in the summer is warm, with cool nights; in the winter often severe, especially on the mountains, where the snow falls to a great depth. Snow also lies to the depth of a foot or two, often for several weeks, in most of the valleys, rendering the use of snow-shoes and sleighs a general necessity. *Shasta valley* is a barren lava plain, containing, however, a few fertile spots. The whole county is particularly adapted to stock-raising, hay for winter being raised upon the meadows along the water-courses, while the hillsides are covered with bunch-grass and other nutritious food. Lumbering and mining are the chief industries of the county.

The average of lands under cultivation is 9 acres per square mile. Supplies are hauled to and from Redding, in Shasta county, the nearest railroad station.

MODOC.

Population: 4,399.

Area: 4,260 square miles.—Sierra mountain lands, 3,685 square miles; Surprise valley, 400 square miles; other valleys, 175 square miles.

Tilled lands: 20,017 acres.—Area planted in wheat, 4,301 acres; in corn, 18 acres; in oats, 774 acres; in barley, 3,956 acres.

Modoc county, in the extreme northeastern corner of the state, has a mountainous and broken surface, drained chiefly by Pitt river, which flows southwestward through the county from Goose lake, on the northern border. The tributaries of this river are chiefly on the south and east, the northwestern part of the county having no drainage system. The only lands suitable for cultivation are embraced in a few of the valleys in the eastern and southern parts of the county, and of these *Surprise valley* is the most important. This valley, lying on the extreme east, extends from north to south, and includes in its eastern side three large lakes, whose lengths are respectively 16, 20, and 15 miles, with widths of from 3 to 5 miles. These lakes have no outlet, and sometimes are dry by evaporation. The length of the valley is about 60 miles and width 15 miles, and it is skirted on two sides by lofty and timbered mountains. It is watered by numerous streams, and is covered with clover and grasses. Its soil is a rich black loam, occupying a strip from 2 to 6 miles in width, whose surface gently slopes toward the lakes. The valley is settled up in neighborhoods, and is partly under cultivation, wheat, barley, and vegetables being the chief crops. Dairying, stock-raising, and lumbering are also carried on to a considerable extent.

The valley of *Goose lake* lies mostly on the eastern side of the lake (which is 30 miles long and 15 miles wide, extending into Oregon), reaching back some 4 or 5 miles, and is watered by numerous small streams. Its lands are good for farming purposes, being covered with bunch and other grasses, and are partly under cultivation, yielding crops of wheat, barley, oats, etc. The adjoining mountains, Warner's range, are heavily timbered with cedar and pine, while on the hillsides and around the lake is an abundant growth of wild plums. On the western side of the lake there is a narrow strip of valley devoted mostly to dairying. *Big* or *Round valley*, on Pitt river, in the southwestern part of the county, and reaching into Lassen county, is 30 miles long and 18 miles wide, and is mostly covered with sage-brush. Its soils are varied in character, from red clays to dark loam and gravelly lands, and spotted with alkali tracts. Surrounding the valley are several creeks, whose rich bottom lands are to some extent under cultivation. Stock-raising is the chief industry. The lands under cultivation average but 4.7 acres per square mile for the county at large.

LASSEN.

Population: 3,340.

Area: 5,000 square miles.—Sierra mountains, 4,425 square miles; valleys, 575 square miles.

Tilled lands: 29,161 acres.—Area planted in wheat, 4,773 acres; in corn, 15 acres; in oats, 1,465 acres; in barley, 1,950 acres.

Lassen county embraces a region of rugged mountains, arid and sandy sage plains, vast areas of alkali flats, and clusters of broken hills, with narrow valleys, and lies on the north and east of the Sierra Nevada mountains, which trend northwest. The Diamond Mountain range, 8,200 feet high, and covered with spruce, pine, and fir, separate it from Plumas county on the south. The other mountains of the county trend in various directions, and have only a few scattered groves of scrubby pitch pine, or "piñon", and dwarf cedar. The only streams of importance are Susan river, in the south, and Pitt river, which crosses the northwestern part of the county, the former, with several tributaries, flowing eastward into Honey lake, while the latter is one of the principal tributaries of the Sacramento. The rest of the county is almost entirely without streams, and includes what is termed the Madaline plains, 5,300 feet above the sea, which is covered with sage-brush. There are several lakes in the southern part of the county covering areas from 12 to 15 miles long and from 8 to 10 miles wide. Comparatively little of the county surface is suitable for cultivation, the chief bodies of arable land being found in Honey Lake valley and in Long valley, farther south.

The lands of the eastern side of Honey lake are dry and barren, but on the western side there is a strip of rich sandy loam soil about 2 miles in width and largely under cultivation, yielding from 25 to 30 bushels of wheat per acre with irrigation, which is found to be very necessary. The elevation of the valley is about 4,200 feet. The land on the streams is a dark loam, and is mostly covered with plums, poplars, and willows.

Long valley reaches southeastward to within 15 miles of Reno, in the state of Nevada, and is quite narrow, except near Honey lake, "its south side being formed by a very high, heavily timbered ridge, while the rise in the north is gradual and the country dry, timberless, and open. The valley is about 40 miles in length, but is very narrow, having an average breadth of only 2 or 3 miles. The principal business of its settlers is the raising of stock and dairying. * * * In the extreme northwestern part of the county, and extending into Modoc county, lies *Big valley*, a large stretch of agricultural lands, comprising in this county about 75,000 acres. * * * The mountains that border the valley on the south and west are timbered with oak, cedar, and pine, while the country on the east consists of long, oval hills and table-lands stretching away to what is known as *Madaline plains*. These hills and table-lands are interspersed with small valleys, which are adapted to grazing purposes. The small valleys are preferred by settlers as locations because of the proximity of timber, and also of the adjacent hills, which constitute a range for stock. * * * Between Big and Honey Lake valleys lie Grasshopper, Willow Creek, Eagle Lake, and Horse Lake valleys, separated from each other and the main valleys by intervening ridges of various heights. Each of the last-named valleys are very small, and contain but few ranches, and are mostly occupied by the bodies of water from which they derive their names (*California As It Is*).

The crops comprise wheat, barley, oats, rye, corn, etc., for which there is a home market. Supplies for the Pitt River region are hauled from Red Bluff in the Sacramento valley; those for the Honey Lake region are hauled from Reno, a railroad station in the state of Nevada.

SHASTA.

(See "Lower foot-hill region".)

TEHAMA.

(See "Lower foot-hill region".)

PLUMAS.

Population: 6,180.

Area: 2,760 square miles.—Lower foot-hills, 100 square miles; higher foot-hills and Sierra mountains, 2,660 square miles.

Tilled lands: 15,791 acres.—Area planted in wheat, 1,129 acres; in oats, 2,574 acres; in barley, 16 acres.

Plumas county is mountainous and very broken, the greater part having an elevation of 3,000 or 4,000 feet above the sea. It is watered by the headwaters of Feather river, which, spreading out toward the northeast and northwest, unite on the southwest and flow toward the Sacramento river. Both these streams have cut their way through gorges and cañons from 300 to 500 feet below the general level of the country, that of Feather river being the deepest in the state. While the central and southwestern part of the county is thus divided into cañons separated by high ridges, the eastern and northern portions rise into the high Sierras over 6,000 feet above the sea.

The surface of the country is well timbered with sugar and yellow pines, spruce, fir, and cedar, the forests being denser upon the slopes of the Sierras than in the lower country on the west and south. Many valleys occur among the high hills of the upper foot-hill region at the base of the Sierra, and are to some extent suited to farming, but especially to grazing purposes, and most of them are covered with grass. The soil is chiefly coarsely sandy and gravelly, producing but little dust in dry seasons.

A series of grassy and well-watered but treeless valleys stretch across the county for 100 miles in a southeastern direction, connected with each other by cañons, passes, or low divides. The first, in the northwestern part of the county, is Big Meadows, comprising some 30,000 acres of fertile land, mostly covered with grasses, and capable of producing crops of grain without irrigation. This, with Mountain Meadows, 15 miles northeastward, and of small area, is mostly devoted to stock-grazing. Butte valley, 5 miles south of Big Meadows, is 3 miles long and 1 mile wide. Greenville is in a small valley 15 miles southeastward of this. Passing southeastward out of this valley, across a well-wooded divide of 4 miles, we come into Indian valley, which has a length of 8 miles and a width of 4 miles, the whole consisting of first-class farming and grazing land, the chief crop of which is oats. Eleven miles southeastward is Genesee valley, distinguished for the large amount of vegetables produced by the few settlers. Clover valley, on the north fork of Feather river, is a long, gorge-like depression, narrow at its lower end, but spreading out as we ascend till it reaches a width of a mile or more. Dairying is the chief pursuit in this valley. A few miles southeastward, over another low wooded divide, brings us to the lower end of Sierra valley, a depression some 20 miles long and 10 miles broad, neither so fertile nor so well watered as the others.—*Pacific Rural Press.*

Oroville, in Butte county, and Reno, in the state of Nevada, are the nearest railroad points from the western and eastern parts of the county, and thence supplies are hauled in wagons.

SIERRA.

Population: 6,623.

Area: 880 square miles.—Lower foot-hills, 200 square miles; higher foot-hills and Sierra mountains, 680 square miles.

Tilled lands: 6,269 acres.—Area planted in wheat, 308 acres; in oats, 1,082 acres; in barley, 391 acres.

Sierra county embraces a region of high mountains and table-lands, only a small portion of its area having an altitude of less than 2,000 feet. The western part is watered by the headwaters of Yuba river, flowing toward the Sacramento valley through deep cañons; the eastern by a few small streams which enter the state of Nevada. A number of small mountain lakes occur on the high table-lands where the Sierra spread out into flats or depressions, Gold lake, with a length of 4 miles and a width of 2 miles, being the source of the middle fork of Feather river.

The eastern half of the county, embracing the Sierra proper, has an elevation of over 4,000 feet, and some of its peaks and buttes rise to 6,000 or 8,000 feet, and are covered with snow for several months of the year, the chief mode of winter travel being with snow-shoes. *Sierra valley* situated among these mountains, is 20 miles long and 10 miles wide, and contains a number of small farms. Owing to its elevation the climate is too severe for ordinary grain crops, but rye and the hardier forage grasses succeed, and stock-breeding is pursued with fair success. The inroads of the grasshopper (*Oedipoda atrox*) are sometimes severely felt in this region. The valley is not well watered. Produce is hauled to Truckee for sale or shipment. The upper foot-hills on the west, with their elevation of from 2,000 to 4,000 feet, cover the larger part of the western half of the county, and embrace a rugged and broken country, and, together with the small area of lower foot-hills, is interspersed with small red and gravelly valleys, which afford the only farming lands.

The county is well timbered with sugar and yellow pines, fir, cedar, spruce, and much wild plum; but the lower foot-hills have chiefly a growth of scrubby oaks. The chief industry of the county is mining and lumbering.

The nearest railroad point to the western section of the county from which supplies may be obtained is Nevada City, in Nevada county, on the south, which is connected by the Northern California railroad with Colfax, and thence by the Central Pacific railroad with Sacramento and other points.

NEVADA.

(See "Lower foot-hill region".)

PLACER.

(See "Lower foot-hill region".)

EL DORADO.

(See "Lower foot-hill region".)

AMADOR.

(See "Lower foot-hill region".)

ALPINE.

Population: 539.
Area: 730 square miles.—All Sierra mountain region.
Tilled lands: 790 acres.—Area planted in wheat, 179 acres; in corn, 8 acres; in oats, 236 acres; in barley, 113 acres.

Alpine county lies upon the summit of the Sierra range and eastward to the state line, and its surface is described as being but a mass of mountain ranges rising as high as 10,000 feet above the sea, the general level being above 4,000 feet. The eastern half of the county embraces almost the only habitations, and is watered by a number of small streams, the headwaters of Carson river, of Nevada. The Mokelumne and Stanislaus rivers rise among the mountains on the west and flow westward through the foot-hill counties into the great valley. Forming the sources of those several streams (on the east) are numerous small lakes, the most of them situated on the summit of the mountain, where it spreads out into a sort of table-land. Many of them are wild and beautiful, being skirted by belts of grass or bordered by plats of lawn-like meadow lands. In some instances they are destitute of these grassy surroundings, being closely hemmed in by dark forests or shadowed by impending cliffs of granite. There are also in this county many grassy, well-watered valleys, rendered the more attractive by their rugged and desolate surroundings. Into these the herdsmen from either side drive their cattle for pasturage during the summer, removing them as winter approaches, the snows in the higher of these valleys always falling to an immense depth.

Alpine county abounds in spruce and pine forests, the timber on the higher Sierra being of large size, while that on the eastern slope and beyond is of inferior quality; three-fourths of the county is thus heavily timbered. Mining and lumbering are the chief industries, and there is very little farming done in the county. Diamond valley, in the northeast, seems to be the only one in which lands are cultivated, even to a small extent, the crops being wheat, barley, hay, oats, and potatoes. The Faith, Hope, and Charity valleys, of the northwest, are inhabited by stock-raisers and dairymen during the summer months, and have an elevation of 7,500 feet above the sea.

CALAVERAS.

(See "Lower foot-hill region".)

TUOLUMNE.

(See "Lower foot-hill region".)

MARIPOSA.

(See "Lower foot-hill region".)

MONO.

Population: 7,499.
Area: 3,400 square miles.—Sierra mountains, with some valleys, all.
Tilled lands: 1,190 acres.—Area planted in wheat, 11 acres; in oats, 12 acres; in barley, 295 acres.

Mono county lies along the eastern border of the state, and is separated from other counties by the high Sierra chain of mountains on the west, which, with an elevation of 13,000 feet, forms a most effectual barrier to transportation in that direction. A central feature of the county is Mono lake, covering a length of 14 miles and a width of 9 miles, whose water is extremely bitter and saline. The northern part of the county is scantily watered by two or more forks of Walker's river, which here have their rise and unite in Nevada, after flowing through deep cañons. On the south are the headwaters of Owen's river, which is the most prominent stream of the county in that portion.

The general altitude of the county is about 6,000 feet, and, besides the Sierra on the west, the eastern part is traversed by the White and Inyo chain of mountains.

The only lands suitable for tillage are situated in the valleys among the Sierra, in small alluvial tracts along Owen's river, and on the two forks of Walker's river. The valleys chiefly in cultivation are Big Meadows and Antelope, each about 15 miles long and 5 miles wide. There is also a little land on the small streams of Mono lake and at the foot of the Sierra, where the streams have formed an alluvial delta extending a short distance out on the plain. Irrigation is necessary to insure good crops on all of the lands. The country, however, east of the Sierra to the state line, is a desert, volcanic in character, abounding in alkali beds, salt pools, and barren table-lands, and destitute of timber, excepting a few scattering willow trees. There is much spruce and pine on the high Sierras, the slopes being well timbered.

Mining is the chief industry of the county, and several large camps are located at the most important mines.

There are comparatively few roads as yet in the county. One, by way of which the mail is carried, leads from Aurora, Nevada, through Blind Springs and Owensville, in Mono county, to Independence, in Inyo county. A wagon-road which cost a large amount of money has been constructed from Bridgeport, the county-seat, over the mountains, by way of the Sonora pass, to Stockton. Bridgeport may also be reached by way of the Central Pacific railroad and Aurora.

INYO.

Population: 2,928.
Area: 8,120 square miles.—Sierra mountains, 1,950 square miles; valleys, 640 square miles; desert lands, 5,530 square miles.
Tilled lands: 13,864 acres.—Area planted in wheat, 1,525 acres; in corn, 1,682 acres; in oats, 791 acres; in barley, 1,686 acres; in vineyards, 22 acres.

Inyo county lies between the state line and the high Sierra Nevada mountains, the western boundary being along the summit of the latter, at an elevation of several thousand feet above the general level of the rest of the

county and 8,000 or 10,000 above the sea, some of the peaks rising to 14,000 and 15,000 feet. Parallel with the Sierra is the White and Inyo chain, lying centrally in the county, and still eastward the shorter chains of Telescope, Panamint, Armargosa, and others. The only stream of importance is Owen's river, on the west, watering a long valley of the same name lying between the Sierra and Inyo mountains. This river has its source in Mono county, on the north, and flows for nearly 100 miles southward into Owen's lake, a large body of salt water about 22 miles long, 8 miles broad and of great depth, which has no outlet. The Armargosa river, on the southeast, rises in Nevada, flows southward at first across this county into San Bernardino county for a short distance, and then turns northwest and disappears in Death valley.

The only tillable lands in the county are embraced in the valleys along Owen's river, at the foot of the Sierra, in a belt varying from a few rods to a mile or more in width and having an alluvial soil, which is very productive under irrigation. *Round valley*, on the extreme north, was first cultivated in 1865, and now produces wheat, oats, barley, etc.; it lies at the foot of the Sierra at an elevation of 4,000 feet, and is 6 miles long and 3 miles wide. *Long valley* has a length of 15 miles, and is chiefly a stock range; but numerous farming settlements occur southward to Independence. All of the country southward from Lone Pine post-office (15 miles south of Independence) and eastward from Owen's river, and embracing the greater part of the county, is a treeless and sandy desert, without water and almost destitute of grass, and is the upper part of the great Mojave desert of the south. It is interspersed with isolated mountain chains and peaks, containing patches of piñon and juniper trees, but otherwise barren. Their valleys have no meadow lands, but several contain extensive alkali flats, beds of salt, and saline and hot springs. A prominent and well-known feature of the southeastern part of the county is the Death valley, which has a length of 45 miles and a width of 15 miles, and sinks to from 150 to 200 feet below the level of the sea. This valley is described more fully on page 43. There is but comparatively little land in the county under cultivation.

Supplies are transported across the desert from Mojave, the nearest railroad station, by means of the peculiar wagon of the West known as the "prairie schooner".

FRESNO.

(See "Great valley region".)

TULARE.

(See "Great valley region".)

KERN.

(See "Great valley region".)

REFERENCE TABLE OF CORRESPONDENTS.

Alameda.—SHERMAN DAY, of Berkeley.
Colusa.—W. S. GREEN, of Colusa.
Fresno and Kern.—N. J. WILLSON, of the Southern Pacific railroad.
Los Angeles.—W. R. OLDEN, J. D. TAYLOR, of Anaheim, and N. J. WILLSON, of the Southern Pacific railroad.
Merced.— H. KELSEY, of Merced, and N. J. WILLSON, of the Southern Pacific railroad.
Monterey.—ED. BERWICK, of Carmel valley.
Napa.—JOHN MAVITY, of Saint Helena.
Sacramento.—DANIEL FLINT and GEORGE RICH, of Sacramento.
San Bernardino and San Diego.—N. J. WILLSON, of the Southern Pacific railroad.
San Luis Obispo.—D. F. NEWSOM, of Newsom Springs.
San Mateo.—J. H. OSGOOD, E. C. BURCH, B. V. WEEKS, and W. G. THOMPSON, of Pescadero.
Solano.—J. M. DUDLEY, of Dixon, and G. C. PEARSON, of Vallejo.
Sonoma.—G. N. WHITAKER, of Santa Rosa.
Stanislaus.—N. J. WILLSON, of the Southern Pacific railroad.
Sutter.—GEORGE OHLEYER, of Yuba City.
Tulare.—F. G. JEFFERDS, of Farmersville, and N. J. WILLSON, of the Southern Pacific railroad.
Tuolumne.—JOHN TAYLOR, of Campo Seco.
Yolo.—R. B. BLOWERS, of Woodland.

REMARKS

ON

COTTON CULTURE IN NEW MEXICO, UTAH, AND ARIZONA,

BY

E. W. HILGARD, PH. D.,

WITH A

REPORT ON THE CULTURE OF COTTON IN MEXICO,

BY

DAVID H. STROTHER,

CONSUL-GENERAL.

50 C P—VOL. II

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COTTON CULTURE

IN

NEW MEXICO, UTAH, AND ARIZONA.

Since the culture of cotton in Texas has extended westward nearly to the foot of the Llano Estacado, the question of its farther progress into New Mexico naturally arises. Inquiry on the subject has elicited no definite statement that cotton is now actually grown within the limits of that territory. There can, however, be little doubt that in the southern portion, and especially in the valley of the Rio Grande, the growing season is long enough and the summer heat is sufficiently high to mature cotton and render its production, at least for local consumption, remunerative. Irrigation is of course required for this as for all annual crops in that region of scanty rainfall.

As regards Utah, the successful cultivation of cotton has been reported from its southwestern portion, near Saint George, in the valley of the Virgin river. Beyond the general statement given above, no information on the subject is available. The inhabitants of the region in question may hereafter find in cotton a crop that can be successfully grown on land too much charged with "alkali" to be utilized for the production of broadcast or less deeply-rooted crops.

Regarding cotton culture in Arizona, some interesting data have been obtained through the courtesy of Governor John C. Frémont, who, upon request, gathered all available information through officers of the army and through intelligent citizens.

It appears from the subjoined abstracts of letters received that cotton has long formed one of the crops of the Pima Indians, who used it in place of wool for making their blankets, but abandoned the culture upon the advent of the Americans, from whom they could procure better blankets in exchange for wheat. Subsequent culture experiments by white settlers have also been successful, so that the subject has passed beyond the experimental stage; and it appears, from the report of Lieutenant Hyde, that near Yuma cotton-plants grow for several years without any special care—a state of things obtaining also in southern San Diego county, California. In the Laguna district of Coahuila, Mexico, the cotton-plant, according to the report of Consul Strother, bears crops for ten years without replanting; and it is obvious that a similar system could be followed in southern Arizona. This, of course, diminishes the cost of cultivation not immaterially, and on this ground Arizona might compete with other cotton-growing states, provided the staple be of acceptable quality. The two samples of fiber from two-year-old plants given in the table of measurements point to the conclusion that such fiber is shorter, and probably coarser, than that from the first year's crop, but that the strength is high. In regard to the proportion of seed to lint, the two determinations give diametrically opposite results, the Yuma cotton having given only 24.16 per cent. of lint, while that from National City gives 39.78 per cent. It is extremely desirable that these points should be farther investigated. It does not seem quite easy to obtain full information as to the relative merits of cotton from annual and older plants, which is doubtless in possession of the planters of Coahuila.

Irrigation is needed for cotton in Arizona as well as in southern California; but it must be borne in mind that cotton, on account of the great depth to which its tap-root goes for moisture, will do with less water than most other crops, especially after the first year. Since, moreover, it is not at all sensitive to alkali, it is probable that much land not available for grain could be used for cotton production in Arizona as well as in California. The exact scope of profitable agriculture in the territory is, as yet, too uncertain, both as to quality and quantity, to warrant confident predictions, the more as the opening of Mexico to railroad communication will bring into competition factors as yet unknown; but it can hardly be doubtful that, among culture plants deserving of earnest attention, cotton occupies no unimportant place.

ABSTRACT FROM A LETTER OF CHARLES T. HAYDEN, HAYDEN FERRY, MARICOPA COUNTY, ARIZONA.

Many farmers in this (Salt River) valley have in different years planted a little cotton, and they and others who have examined it are satisfied that it could be successfully raised. With the abundant water-power I have here (24 feet fall and an abundance of water) a mill to manufacture heavy cotton cloth, such as goes so largely into consumption in this part of the territory, would enable planters and mills to be successful without doubt if conducted with ordinary economy and intelligence.

The Pima Indians, before Americans occupied this territory, and for a few years after, raised cotton on the Pima reservation, enough to make many blankets for their own use, woven after the style of the Navajo blanket, substituting cotton for wool. The facility for buying American blankets with wheat after the occupation of Arizona by our government caused the discontinuance of raising cotton by said Indians.

ABSTRACT FROM A LETTER OF LIEUTENANT M. E. HYDE, EIGHTH INFANTRY, FORT YUMA.

Mr. David Neahr, one of the oldest merchants of Yuma, raised in 1860 about 200 cotton-plants on the flat below the mouth of the Gila river, on the Arizona side. Some seed were planted in February and some in March, the latter doing best. The plants grew rank and luxuriant, and the crop was ready to pick by July 4. Of course irrigation was necessary. This was a family experiment. The sample sent to you is from a plant in the quartermaster's department grounds, which has been growing for two years, and possibly longer, without any special attention.

REPORT ON THE CULTURE OF COTTON IN THE REPUBLIC OF MEXICO.

[The subjoined report on the cultivation of cotton in Mexico was obtained through the state department at the request of the Superintendent of Census.]

The cotton-plant is supposed to be indigenous on the gulf coast of Mexico, as Cortes, on his first landing, found the natives clothed in cotton fabrics of their own manufacture. It is said to be an exotic on the Pacific side, but the reasons for this opinion are not so satisfactorily stated. Its culture has been continued to the present day throughout the country, but with very little improvement in the modes and methods which existed at the time of the conquest. The principal cotton-producing states are Vera Cruz, Guerrero, Jalisco, Sinaloa, Chiapas, Oaxaca, Colima, Michoacan, Sonora, Chihuahua, Durango, and Coahuila.

From the states of Chiapas, Oaxaca, Michoacan, and Chihuahua I have not been able to obtain any reports whatever.

While this leaves us without a basis for even a conjectural estimate of the whole amount produced in the republic, we may nevertheless suppose that the general conditions of production and preparation for market are very nearly the same in these states as in those from which we have heard. In regard to the question of wages, it should be observed that the figures named in the majority of the reports represent the prices paid in or near the maritime cities, or in the northern districts where the wages of laborers are affected by their propinquity to the United States. In the interior and remote towns and districts of the republic the wages of labor seldom exceed a real (12½ cents) per day, sometimes without food, and sometimes with the addition of a small measure of corn (cuartillo), equivalent to about three pints, and worth about 6¼ cents. It would therefore be safe to estimate the average cost of labor in Mexico at 20 cents per day. From the foregoing figures it is evident that the condition of the common laborer in Mexico is very humble; yet, in view of the cheapness of living and the small requirements of life in this climate, this per diem is adequate to his maintenance, and, considering the inefficient and primitive methods used, his labor is not worth more than the wages paid.

The native operatives in the factories are better paid, and, under the superintendence of Europeans or directors of experience, are esteemed excellent factory hands, quite equal to the average of those employed in England or the United States. Indeed, they seem to possess a special aptitude for all work requiring patience and delicate manipulation, and exhibit a high degree of the imitative faculty which characterizes the Chinaman. What they seem to lack is the capacity (or habit) of organization and the ability to manage fine and complicated machinery. For the rest, the childlike improvidence and recklessness of the future which characterizes the laboring masses of this country is the principal barrier to their intellectual and material improvement.

The usual time for planting cotton is in June and July, according to the greater or less amount of moisture contained in the soil selected, and they begin to gather the crop in February.

In this brief report I have embodied all the information I have been enabled to gather on the culture of cotton in this country, regretting that my report is necessarily so vague and imperfect.

VERA CRUZ.

The product of this state is estimated at about 8,000,000 pounds per annum. There are no data to enable us to estimate the product per acre, as land in this state is not measured by the acre, but rudely estimated by the square league, or by the still more unreliable standard of the "caballeria", which signifies as much as a horse can travel round in a day.

The plant, however, grows so vigorously that each stalk yields from two to five hundred pods, and it is calculated that the average yield to the acre is about 15 per cent. more than in the United States.

After selecting sufficient seed for the next year's sowing, the remainder is used as fuel, cattle feed, or to manure the land. The seeds are separated from the lint almost universally by the steam cotton-gins from the United States.

The field labor in the cultivation of cotton is performed in the most primitive manner and entirely without the aid of modern improved implements. The wages paid a laborer in the vicinity of Vera Cruz is fifty cents a day and maintenance, or sixty-two and a half cents without. In remoter sections of the state these figures may be reduced to one-half.

GUERRERO.

It is estimated that this state produces 5,300,000 pounds of cotton in the seed, about one-third of which, 33⅓ per cent., is pure fiber. We have no data to calculate the average produce per acre and no means of even approximating the amount of land under culture.

Under the present system the great proprietors do not find cotton culture profitable, and consequently it is chiefly raised by small renters, who cultivate it in irregular patches by their own labor and the assistance of their families.

In view, however, of the fertile soil and favorable climate of this region, it is believed that in the hands of more enterprising and intelligent cultivation the states of Guerrero and Oaxaca could be made to produce more cotton than all the southern states of the American Union combined.

The cotton crop of Guerrero is cleaned by 13 American steam gins, 2 water-power and 3 horse-power gins. The seed is used for fuel and cattle feed.

The average pay of laborers is 37½ cents per diem.

There is one cotton-mill in the state, with forty-eight looms, manufacturing goods for local use. There is also a considerable amount manufactured by hand looms. The remainder of the crop is sold for the mills of Michoacan, Jalisco, Colima, and Sinaloa. The pure lint brings 15 cents per pound, and is packed in bales weighing 150 or 160 pounds each.

JALISCO.

The crop in this state is about 2,000,000 pounds per annum. There is no conjecture as to the acreage under cultivation.

It is estimated that an acre will produce 1,000 pounds of seed-cotton, of which one-third is pure fiber. The wages of laborers are from 37½ to 50 cents per diem. The seed is used for fuel, cattle feed, and manure.

American steam cotton-gins are generally in use to prepare the crop for market.

COLIMA.

The annual crop of this state is stated at 257,000 pounds. Replies in response to all other questions are the same as for Jalisco.

SINALOA.

The estimated annual crop of this state is 1,750,000 pounds. The average yield per acre is estimated at 1,050 pounds; of seed, 700 pounds; of pure fiber, 350 pounds. The seed is used for fuel at the gas works—one-third cotton seed and two-thirds coal. It is also used for cattle feed, and is sold at 75 cents per quintal. The average wages of laborers are 50 cents per diem, and in remote localities 25 cents per diem and maintenance.

The American steam cotton-gin called the Eagle is the only machine used in this district. There are three cotton factories in operation in Sinaloa, but the whole crop of this state, two-thirds of that of Sonora, and considerable importations from Guerrero, all combined, do not suffice fully to supply the mills.

The crop in this region suffers from superabundance of rain and from insects, and is considered very uncertain.

SONORA.

The crop of this state averages about 1,000,000 pounds per annum, and the responses to other questions are the same as in Sinaloa. Three years ago the culture of cotton was introduced into Lower California, and the crop is reported at 500,000 pounds. The crop is said to be more certain there than elsewhere in Mexico, and is of decidedly superior quality. Its culture is now engaging the attention of landholders in that section, and great hopes are entertained of its future.

DURANGO.

The annual product of this state is estimated at 4,000,000 pounds; the product per acre at 1,500 pounds, yielding 420 pounds pure lint. The American steam gin and some few horse-power gins are some of the machines used for cleaning the cotton. The seeds are used for heating steam-boilers and for feeding cattle.

Laborers' wages are nominally 75 cents per diem, but, being paid in high-priced goods, they are equivalent to not more than 30 cents in cash.

Cotton gatherers are paid from 12½ to 25 cents per aroba (25 pounds), and an active man can gather six arobas in a day. The crops suffer very seriously from the attacks of vermin, such as worms, locusts, and pocks (*viruela*).

COAHUILA.

The annual production of this state is estimated at 3,000,000 pounds; last year's crop, being a partial failure, did not probably exceed 1,250,000 pounds. Machinery, wages, and other details are the same as in Durango. In the Laguna cotton is perennial and does not require to be planted oftener than once in ten years. This district, containing about 1,200,000 acres, lies partly in Coahuila and partly in Durango. It is of extraordinary fertility and well adapted to cotton, but is very little cultivated, and the cotton product of Coahuila is diminishing yearly.

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Deep plowing in preparation of the land	I	81	453
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Georgia	II	168	434
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Mississippi	I	150	352
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Mississippi	I	152, 153	354, 355
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North Carolina	II	76	608
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Georgia	II	174	440
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Florida	II	68	248
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Indian territory	I	30	868
Louisiana	I	80	182
Mississippi	I	151	353
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Tennessee	I	6–8	378–380
Texas	I	7–10	665–668
Virginia	II	3	625
Corn, acreage greater than that of cotton in Arkansas	I	39	575
Corn, soil ingredients withdrawn by (General Discussion).	I	50	62
Correspondents, abstracts of reports of, in monograph on:			
Alabama	II	78–148	88–158
Arkansas	I	49–94	585–630
Florida	II	38–60	218–240
Georgia	II	70–158	336–424
Indian territory	I	22–25	866–863
Louisiana	I	44–73	146–175
Mississippi	I	88–143	290–345
Missouri	I	15–18	513–516
North Carolina	II	30–64	562–596
South Carolina	II	54–58	510–514
Tennessee	I	48–92	420–464
Texas	I	60–148	718–806
Virginia	II	12–14	634–636
Correspondents, names and addresses of, in:			
Alabama	II	150–152	160–162
Arkansas	I	96	633
California	II	125	783
Florida	II	66	246
Georgia	II	160–162	426–428
Indian territory	I	28	866
Louisiana	I	76	178
Mississippi	I	146	348
Missouri	I	24	522
North Carolina	II	72	604
South Carolina	II	50	506
Correspondents, names and addresses of, in—cont'd.			
Tennessee	I	94–96	466–468
Texas	I	150–152	808–810
Virginia	II	18	640
Corundum, occurrence of, in South Carolina	II	19	466
Cost of cotton picking in:			
Arkansas	I	101	637
Florida	II	68	248
Georgia	II	176	442
Mississippi	I	155	357
North Carolina	II	78	610
South Carolina	II	55	511
Texas	I	163	821
Virginia	II	20	642
Cost of cotton picking in Mexico (in Report on California).	II	131	789
Cost of cotton production, estimated, in:			
Alabama	II	156	166
Arkansas	I	107	643
California	II	76	734
Florida	II	71	251
Georgia	II	175	441
Indian territory	I	31	869
Louisiana	I	85	187
Mississippi	I	155	357
Missouri	I	28	526
North Carolina	II	78	610
South Carolina	II	66	522
Tennessee	I	105	477
Texas	I	163	821
Virginia	II	21	643
Cost of cotton production, itemized, in:			
Alabama	II	156	166
Arkansas	I	107	643
California	II	76	734
Georgia	II	175, 176	441, 442
Louisiana	I	85	187
Missouri	I	28	526
North Carolina	II	78	610
Tennessee	I	105	477
Texas	I	163	821
Cost of drayage in:			
Arkansas	I	107	643
Louisiana	I	85	187
Mississippi	I	155	357
North Carolina	II	78	510
Tennessee	I	105	477
Texas	I	162	820
Cost of sale, charges, and insurance on cotton crop in:			
Alabama	II	156	166
Arkansas	I	106, 107	642, 643
Florida	II	71	251
Georgia	II	174	440
Indian territory	I	31	869
Louisiana	I	85	187
Mississippi	I	155	357
Missouri	I	28	526
North Carolina	II	78	610
Tennessee	I	104, 105	476, 477
Texas	I	162	820
Virginia	II	21	643
Côte Blanche island, Louisiana, location of	I	23	125
Côte Gelée, Louisiana, description of	I	24, 59	126, 161
Cotton, acreage and production of, in:			
Alabama	II	3–6, 60	13–16, 70
Arkansas	I	3–6, 39, 40	539–542, 575, 576
Florida	II	3, 4, 29	183, 184, 209
Georgia	II	3–8, 54, 55	269–274, 320, 321
Kentucky (in Report on Tennessee)	I	109	481
Louisiana	I	3, 4, 35, 36	105, 106, 137, 138
Mississippi	I	3–6, 72	205–208, 274
Missouri	I	3, 4	501, 502
North Carolina	II	3–6	535–538
South Carolina	II	3	459
Tennessee	I	3–8	375–380
Texas	I	3–6, 49, 51	661–664, 707, 709
Virginia	II	3, 10	625, 632
Cotton acreage and tilled land in Louisiana, greatest disproportion between.	I	39	141
Cotton, after-cultivation of, in:			
Alabama	II	154	164
Arkansas	I	100	636
California	II	75	733
Florida	II	68	248
Georgia	II	167	433
Indian territory	I	30	868
Louisiana	I	80	182
Mississippi	I	150	352
Missouri	I	26	524
North Carolina	II	74	606
South Carolina	II	55–58	511–514
Tennessee	I	99, 100	471, 472
Texas	I	156	814
Virginia	II	20	642

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California	II	75	733
Mississippi	I	155	357
North Carolina	II	78	610
Cotton, amount of, picked per day by Chinese in California.	II	75	733
Cotton, average prices for short- and long-staple in Florida.	II	30	210
Cotton baling, capacity and presses used for, in:			
Alabama	II	155	165
Arkansas	I	102	638
Florida	II	69	249
Georgia	II	170	436
Indian territory	I	30	868
Louisiana	I	81	183
Mississippi	I	152	354
Missouri	I	27	525
North Carolina	II	75	607
South Carolina	II	58	514
Tennessee	I	101, 102	473, 474
Texas	I	158	816
Virginia	II	20	642
Cotton baling, fastening used in, in:			
Alabama	II	155	165
Arkansas	I	102	638
Florida	II	69	249
Georgia	II	58, 170	324, 436
Indian territory	I	30	868
Louisiana	I	81	183
Mississippi	I	152	354
Missouri	I	27	525
North Carolina	II	75	607
South Carolina	II	58	514
Tennessee	I	102	474
Texas	I	158	816
Virginia	II	20	642
Cotton baling, ginning, and shipping in:			
Alabama	II	154, 155	164, 165
Arkansas	I	101	637
Florida	II	30, 69	210, 249
Georgia	II	169, 170	435, 436
Indian territory	I	30	868
Louisiana	I	81	183
Mississippi	I	151	353
Missouri	I	27	525
North Carolina	II	75	607
South Carolina	II	58	514
Tennessee	I	101, 102	473, 474
Texas	I	157, 158	815, 816
Virginia	II	20	642
Cotton blooms first appear, when, in:			
Alabama	II	154	164
Arkansas	I	100	636
California	II	75	733
Florida	II	68	248
Georgia	II	168	434
Indian territory	I	30	868
Louisiana	I	80	182
Mississippi	I	150	352
Missouri	I	26	524
North Carolina	II	74	606
South Carolina	II	55–58	511–514
Tennessee	I	100	472
Texas	I	156	814
Virginia	II	20	642
Cotton bolls first open, when, in:			
Alabama	II	154	164
Arkansas	I	100	636
California	II	75	733
Florida	II	68	248
Georgia	II	168	434
Indian territory	I	30	868
Louisiana	I	80	182
Mississippi	I	150	352
Missouri	I	26	524
North Carolina	II	74	606
South Carolina	II	55–58	511–514
Tennessee	I	100	472
Texas	I	156	814
Virginia	II	20	642
Cotton bolls, number of, on each plant in California	II	75	733
Cotton, charges, cost of sale, and insurance of crop, in:			
Alabama	II	156	166
Arkansas	I	106, 107	642, 643
Florida	II	71	251
Georgia	II	174	440
Indian territory	I	31	869
Louisiana	I	85	187
Mississippi	I	155	357
Missouri	I	28	526
North Carolina	II	78	610
Tennessee	I	104, 105	476, 477
Texas	I	162	820
Virginia	II	12	634
Cotton, cost of production per pound or per bale in:			
Alabama	II	156	166
Arkansas	I	107	643
Florida	II	71	251
Georgia	II	58, 175	324, 441
Indian territory	I	31	869
Louisiana	I	85	187
Mississippi	I	155	357
Missouri	I	28	526
North Carolina	II	75	610
South Carolina	II	66	522
Tennessee	I	105	477
Texas	I	163	821
Virginia	II	21	643
Cotton crops affected by accidents of weather in:			
Alabama	II	155	165
Arkansas	I	102, 103	638, 639
Florida	II	69, 70	249, 250
Georgia	II	170, 171	436, 437
Indian territory	I	30	868
Louisiana	I	81, 82	183, 184
Mississippi	I	152	354
Missouri	I	27	525
North Carolina	II	76	608
South Carolina	II	59, 60	515, 516
Tennessee	I	102	474
Texas	I	158, 159	816, 817
Virginia	II	20	642
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Cotton culture affected by troublesome weeds in:			
Alabama	II	75–148	85–158
Arkansas	I	49–94	585–630
Florida	II	38–60	218–240
Georgia	II	72–158	338–424
Indian territory	I	22–25	860–863
Louisiana	I	44–73	146–175
Mississippi	I	78, 87–143	280, 289–345
Missouri	I	15–18	513–516
North Carolina	II	30–64	562–596
South Carolina	II	57–60	513–516
Tennessee	I	43, 69–74	415, 441–446
Texas	I	60–148	718–806
Virginia	II	11–15	633–637
Cotton culture in:			
Alabama, use of commercial fertilizers in	II	65	75
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California, Santa Clara valley	II	48	706
Georgia, intensive system of	II	58, 59, 175	324, 325, 441
Mississippi, intense system of, recommended	I	78	280
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Cotton diseases, insect enemies, etc., in:			
Alabama	II	155	165
Arkansas	I	102, 103	638, 639
Florida	II	69, 70	249, 250
Georgia	II	170, 171	436, 437
Indian territory	I	30	868
Louisiana	I	81–83	183–185
Mississippi	I	152, 153	354, 355
Missouri	I	27	525
North Carolina	II	76	606
South Carolina	II	59, 60	515, 516
Tennessee	I	102, 103	474, 475
Texas	I	158–160	816–818
Virginia	II	20	642
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Cotton from frost-bitten bolls light and inferior in Alabama.	II	82	92
Cotton ginning, power used in, in:			
Alabama	II	154	164
Arkansas	I	101	637
Florida	II	68	148
Georgia	II	69, 169, 170	335, 435, 436
Indian territory	I	30	868
Louisiana	I	81	183
Mississippi	I	151	353
Missouri	I	27	525
North Carolina	II	75	607
South Carolina	II	58	514
Tennessee	I	101	473
Texas	I	157	815
Virginia	II	20	642
Cotton ginning, power used in, in Mexico (in Report on California).	II	131	789
Cotton gins, list and capacity of, in:			
Alabama	II	154, 155	164, 165
Arkansas	I	101	637
California	II	76	734
Florida	II	69	249
Georgia	II	169, 170	435, 436
Indian territory	I	30	868
Louisiana	I	81	183
Mississippi	I	151	353
Missouri	I	27	525
North Carolina	II	75	607
South Carolina	II	58	514
Tennessee	I	101	473
Texas	I	157, 158	815, 816
Virginia	II	20	642
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California, effect of the climate of the great valley upon.	II	11	669
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Cotton lint made by gins in a day's run in:			
Alabama	II	155	165
Arkansas	I	101	637
Florida	II	69	249
Georgia	II	169, 170	435, 436
Indian territory	I	30	868
Louisiana	I	81	183
Mississippi	I	151	353
Missouri	I	27	525
North Carolina	II	75	607
South Carolina	II	58	514

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Tennessee	I	101	473
Texas	I	157	815
Virginia	II	20	642
Cotton lint, price and weight of bales of, in Mexico (in Report on California).	II	131	789
Cotton, character of, in Arizona (General Discussion).	I	9	21
Cotton picking, cost of, in:			
Arkansas	I	101	637
Florida	II	68	248
Georgia	II	176	442
Mississippi	I	155	357
North Carolina	II	78	610
South Carolina	II	55	511
Texas	I	163	821
Virginia	II	20	642
Cotton picking, cost of, in Mexico (in Report on California).	II	130, 131	788, 789
Cotton picking season begins, when, in:			
Alabama	II	114, 154	124, 164
Arkansas	I	101	637
California	II	75	733
Florida	II	68	248
Georgia	II	168, 176	434, 442
Indian territory	I	30	868
Louisiana	I	80	182
Mississippi	I	151	353
Missouri	I	26	514
North Carolina	II	75	607
South Carolina	II	55–58	511–514
Tennessee	I	100	472
Texas	I	157	815
Virginia	II	20	642
Cotton picking season closes, when, in:			
Alabama	II	114, 154	124, 164
Arkansas	I	101	637
California	II	75	733
Florida	II	68	248
Georgia	II	168, 176	434, 442
Indian territory	I	30	868
Louisiana	I	80	182
Mississippi	I	151	353
Missouri	I	26	524
North Carolina	II	75	607
South Carolina	II	55–58	511–514
Tennessee	I	100	472
Texas	I	157	815
Virginia	II	20	642
Cotton picking, time of, in Arizona (in Report on California).	II	130	788
Cotton picking, time of, in Mexico (in Report on California).	II	131	789
Cotton pickings made, number of, in:			
Alabama	II	154	164
Arkansas	I	101	637
California	II	75	733
Florida	II	68	248
Georgia	II	168	434
Indian territory	I	30	868
Louisiana	I	80	182
Mississippi	I	151	353
Missouri	I	26	524
North Carolina	II	75	607
South Carolina	II	57	513
Tennessee	I	100	472
Texas	I	157	815
Virginia	II	29	651
Cotton-plant, height attained by, before blooming in:			
Alabama	II	154	164
Arkansas	I	100	636
Florida	II	68	248
Georgia	II	168	434
Indian territory	I	22–25	860–863
Louisiana	I	80	182
Mississippi	I	150	352
Missouri	I	26	524
North Carolina	II	74	606
South Carolina	II	55–58	511–514
Tennessee	I	100	472
Texas	I	156	814
Virginia	II	20	642
Cotton-plant in California:			
Irrigation of	II	75	733
Not sensitive to alkali	II	129	787
Cotton-plant indigenous in the Gulf of Mexico region (in Report on California).	II	130	788
Cotton-plant running to weed in:			
Alabama	II	75–148	85–158
Arkansas	I	49–94	585–630
Florida	II	38–60	218–240
Georgia	II	67–158	333–424
Indian territory	I	22–25	860–863
Louisiana	I	44–73	146–175
Mississippi	I	88–143	290–345
Missouri	I	15–18	513–516
North Carolina	II	30–64	562–596

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South Carolina	II	59, 60	515, 516
Tennessee	I	48–92	420–464
Texas	I	60–148	718–806
Virginia	II	12–14	634–636
Cotton-plant, running to weed of the, a peculiarity of the coast region of Georgia.	II	158	424
Cotton-plant, usual height of, in:			
Alabama	II	75–148	85–158
Arkansas	I	49–94	585–630
California	II	75	733
Florida	II	30, 38–60	210, 218–240
Georgia	II	70–158	336–424
Indian territory	I	22–25	860–863
Louisiana	I	44–73	146–175
Mississippi	I	88–143	290–345
Missouri	I	15–18	513–516
North Carolina	II	30–64	562–596
Tennessee	I	48–92	420–464
Texas	I	57–148	715–806
Virginia	II	12–14	634–636
Cotton planting and cultivation, details of, in:			
Alabama	II	154	164
Arkansas	I	99–101	635–637
California	II	75, 76	733, 734
Florida	II	68, 69	248, 249
Georgia	II	57, 58, 166–169	323, 324, 432–435
Indian territory	I	29, 30	867, 868
Louisiana	I	79, 80	181, 182
Mississippi	I	149–151	351–353
Missouri	I	26	524
North Carolina	II	74, 75	606, 607
South Carolina	II	26, 54–58	482, 510–514
Tennessee	I	42, 43, 99, 100	414, 415, 471, 472
Texas	I	155–157	813–815
Virginia	II	19, 20	641, 642
Cotton-plants, time of thinning out, and how far apart, in:			
Alabama	II	154	164
Arkansas	I	100	636
California	II	75	733
Florida	II	68	248
Georgia	II	167	433
Indian territory	I	29	867
Louisiana	I	79, 80	181, 182
Mississippi	I	150	352
Missouri	I	26	524
North Carolina	II	74	606
South Carolina	II	55–58	511–514
Tennessee	I	99	471
Texas	I	156	814
Virginia	II	19	641
Cotton, points considered in the commercial grading of (General Discussion).	I	36	48
Cotton product per acre, by regions, in:			
Alabama	II	60	70
Arkansas	I	40	576
Florida	II	29–31	209–211
Georgia	II	54, 55, 67–158	320, 321, 333–424
Indian territory	I	10–25	848–863
Louisiana	I	34	136
Mississippi	I	72	274
Missouri	I	11	509
North Carolina	II	21	553
Tennessee	I	40	412
Texas	I	49	707
Virginia	II	10	632
Cotton product, per acre, in:			
Each agricultural region of the cotton states (General Discussion).	I	4	16
Mexico (in Report on California)	II	131	789
Cotton product per acre on any soil and on fresh and old lands in:			
Alabama	II	75–148	85–158
Arkansas	I	49–94	585–630
California	II	27	685
Florida	II	38–60	218–240
Georgia	II	70–158	336–424
Indian territory	I	22–25	860–863
Louisiana	I	44–73	146–175
Mississippi	I	88–143	290–345
Missouri	I	15–21	513–519
North Carolina	II	30–64	562–596
Tennessee	I	48–92	420–464
Texas	I	57–148	715–806
Virginia	II	12–14	634–636
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Alabama	II	14–56, 60	24–66, 70
Arkansas	I	39, 40	575, 576
Florida	II	28–31	209–211
Georgia	II	54–57	320–323
Indian territory	I	3, 21–25	841, 859–863
Kentucky (in Report on Tennessee)	I	111	483
Louisiana	I	32–35	134–137
Mississippi	I	72–76	274–278
Missouri	I	3–9	501–507
North Carolina	II	21, 22	553, 554
South Carolina	II	19–47	475–503
Tennessee	I	17, 25, 36, 38, 40	389, 397, 408, 410, 412
Texas	I	49, 50	707, 708
Virginia	II	10	632
Cotton production, agricultural methods of, in:			
Alabama	II	154	164
Arkansas	I	99–101	635–637
California	II	75, 76	733, 734
Florida	II	68, 69	248, 249
Georgia	II	57, 58, 166–169	223, 224, 432–435
Indian territory	I	29, 30	867, 868
Louisiana	I	79, 80	181, 182
Mississippi	I	77–79	279–281
Missouri	I	26	524
North Carolina	II	74, 75	606, 607
South Carolina	II	26, 54–58	482, 510–512
Tennessee	I	42, 43, 99, 100	414, 415, 471, 472
Texas	I	155–157	813–815
Virginia	II	19, 20	641, 642
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Cotton production, cultural and economic details of, in:			
Alabama	II	149–156	159–166
Arkansas	I	95–108	631–644
Florida	II	65–71	245–251
Georgia	II	159–176	425–442
Indian territory	I	27–31	865–869
Louisiana	I	75–85	177–187
Mississippi	I	145–155	347–357
Missouri	I	23–28	521–526
North Carolina	II	71–78	603–610
South Carolina	II	49–66	505–522
Tennessee	I	93–105	465–477
Texas	I	149–163	807–821
Virginia	II	17–21	639–643
Cotton production per acre, areas, population, and tilled lands, by counties, in:			
Alabama	II	3, 4	13, 14
Arkansas	I	3, 4	539, 540
California (no cotton production reported)	II	3, 4	661, 662
Florida	II	3	183
Georgia	II	3–5	269–271
Indian territory	I	3	841
Kentucky (in Report on Tennessee)	I	109	481
Louisiana	I	3, 4	105, 106
Mississippi	I	3, 4	205, 206
Missouri	I	3, 4	501, 502
North Carolina	II	3, 4	535, 536
South Carolina	II	3	459
Tennessee	I	3–8	375–380
Texas	I	3–6	661–664
Virginia	II	3	625
Cotton production, estimated cost of, per pound or bale, in:			
Alabama	II	156	166
Arkansas	I	107	643
California	II	76	734
Florida	II	71	251
Georgia	II	175	441
Indian territory	I	31	869
Louisiana	I	85	187
Mississippi	I	155	357
Missouri	I	28	526

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Cotton production, estimated cost of, per pound or bale, in—continued.			
North Carolina	II	78	610
South Carolina	II	66	522
Tennessee	I	105	477
Texas	I	163	821
Virginia	II	21	643
Cotton production, general remarks on, in:			
Alabama	II	60–64	70–74
Arkansas	I	38–41	574–577
California	II	73–78	731–736
Florida	II	29–33	209–213
Georgia	II	53–61	319–327
Indian territory	I	16	854
Kentucky (in Report on Tennessee)	I	111, 112	483, 484
Louisiana	I	32–39	134–141
Mississippi	I	71–79	273–281
Missouri	I	17	515
North Carolina	II	21, 22	553, 554
South Carolina	II	21–47	477–503
Tennessee	I	40–43	412–415
Texas	I	48–52	706–710
Virginia	II	10	632
Cotton production in:			
California, history of	II	73–75	731–733
California, premiums offered for	II	73, 74	731, 732
Georgia, early history of	II	53, 54	319, 320
Indian territory by the—			
Cherokee nation	I	21, 22	859, 860
Chickasaw nation	I	24	862
Choctaw nation	I	23, 24	861, 862
Creek nation	I	22	860
Pottawatomie nation	I	25	863
Seminole nation	I	23	861
Louisiana requires a larger proportion of pure manual labor than that of other crops.	I	38	140
Mississippi, change of methods of culture, etc., in, necessary.	I	79	281
Missouri, area of, embraced in the several census years.	I	10, 11	508, 509
North Carolina, increase of, since 1870	II	22	554
South Carolina, early history of	II	14	470
Texas, early history of	I	48	706
Cotton production, increase of, on belts of calcareous soils (General Discussion).	I	3	15
Cotton production, itemized cost of, in:			
Alabama	II	156	166
Arkansas	I	107	643
California	II	76	734
Georgia	II	175, 176	441, 442
Louisiana	I	85	187
Missouri	I	28	526
North Carolina	II	78	610
Tennessee	I	105	477
Texas	I	163	821
Cotton production, percentage of state's total, in each region of:			
Alabama	II	60	70
Arkansas	I	40, 41	576, 577
Florida	II	29	209
Georgia	II	54	320
Louisiana	I	38	140
Mississippi	I	72	274
North Carolina	II	21	553
Tennessee	I	40	412
Texas	I	49	707
Virginia	II	10	632
Cotton samples, requests made for, and number obtained for measurement (General Discussion).	I	12	24
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Variety of, in Georgia	II	52, 53	318, 319
Cotton, seasons most favorable for, in South Carolina.	II	26	482
Cotton shipments in:			
Alabama	II	75–148, 156	85–158, 166
Arkansas	I	41, 43–94, 107	577, 585–630, 643
Florida	II	69, 71	249, 251
Georgia	II	59, 67–158	325, 333–424
Indian territory	I	16	854
Louisiana	I	43–73, 85	145–175, 187
Mississippi	I	87–143, 151, 155	289–345, 353, 357
Missouri	I	15–21	513–519
North Carolina	II	27–70, 78	559–602, 610
Tennessee	I	47–92, 105	419–464, 477
Texas	I	52, 57–148, 162	710, 715–806, 820
Virginia	II	11–15, 21	633–637, 643
Cotton, soil ingredients withdrawn by (General Discussion).	I	50	62
Cotton soils, most important, from what geological horizon derived in Tennessee.	I	13	385
Cotton, staple, rating of, in:			
Alabama	II	75–148	85–158
Arkansas	I	49–94	585–630
Florida	II	38–60	218–240
Georgia	II	70–158	336–424
Indian territory	I	22–25	860–863
Louisiana	I	43–73	145–175
Mississippi	I	88–143	290–345
Missouri	I	16–18	514–516
North Carolina	II	30–64	562–596
Tennessee	I	48–92	420–464
Texas	I	60–148	718–806
Virginia	II	12–14	634–636
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Value of, as a fertilizer in Tennessee	I	98	470
Cottonseed and lint, in tons, in each region of:			
Alabama	II	60	70
Arkansas	I	40	576
Florida	II	29	209
Georgia	II	54	329
Louisiana	I	32	134
Mississippi	I	72	274
North Carolina	II	21	553
Tennessee	I	40	412
Texas	I	49	707
Virginia	II	10	632
Cottonseed, disposal and price of, and variety and amount used per acre in:			
Alabama	II	154	164
Arkansas	I	98, 99	634, 635
California	II	76	734
Florida	II	67, 68	247, 248

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Georgia	II	57, 58, 165, 166	323, 324, 431, 432
Indian territory	I	29	867
Louisiana	I	78, 79	180, 181
Mississippi	I	148, 149	350, 351
Missouri	I	25, 26	523, 524
North Carolina	II	73, 74	605, 606
South Carolina	II	52–58	508–514
Tennessee	I	43, 98, 99	415, 470, 471
Texas	I	154, 155	812, 813
Virginia	II	19	641
Cottonseed, length of time before coming up in:			
Alabama	II	154	164
Arkansas	I	99	635
California	II	75	733
Florida	II	68	248
Georgia	II	167	433
Indian territory	I	29	867
Louisiana	I	79	181
Mississippi	I	149	351
Missouri	I	26	524
North Carolina	II	74	606
South Carolina	II	55–58	511–514
Tennessee	I	99	471
Texas	I	155	813
Virginia	II	19	641
Cottonseed, variety preferred in:			
Alabama	II	154	164
Arkansas	I	98, 99	634, 635
California	II	76	734
Florida	II	67, 68	247, 248
Georgia	II	57, 58, 165, 166	323, 324, 431, 432
Indian territory	I	29	867
Louisiana	I	78, 79	180, 181
Mississippi	I	148, 149	350, 351
Missouri	I	25, 26	523, 524
North Carolina	II	73, 74	605, 606
South Carolina	II	52–58	508–514
Tennessee	I	43, 98, 99	415, 470, 471
Texas	I	154, 155	812, 813
Virginia	II	19	641
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Without the hulls, equivalent to three-quarters of the seed (General Discussion).	I	43	55
Cottonseed-oil cake used as feed or manure in:			
Alabama	II	154	164
Arkansas	I	98	634
Florida	II	67	247
Georgia	II	166	432
Indian territory	I	29	867
Louisiana	I	79	181
Mississippi	I	148	350
Missouri	I	25	523
North Carolina	II	73	605
South Carolina	II	52–54	508–510
Tennessee	I	98	470
Texas	I	154	812
Virginia	II	19	641

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Cottonseed-planters used in:			
Alabama	II	154	164
Arkansas	I	99	635
Florida	II	68	248
Georgia	II	167	433
Louisiana	I	79	181
Mississippi	I	149	351
Missouri	I	26	524
North Carolina	II	74	606
South Carolina	II	55	511
Tennessee	I	99	471
Texas	I	155	813
Virginia	II	19	641
Coulées in Louisiana, description of	I	22	124
Counties, agricultural descriptions of the, of:			
Alabama	II	75–148	85–158
Arkansas	I	47–94	583–630
California	II	85–125	743–783
Florida	II	35–63	215–243
Georgia	II	67–158	333–424
Louisiana	I	41–73	143–175
Mississippi	I	85–143	287–345
Missouri	I	13–21	511–519
North Carolina	II	27–70	559–602
Tennessee	I	45–92	417–464
Texas	I	57–148	715–806
Virginia	II	11–15	633–637
Counties, area, population, tilled lands, and cotton production of, in:			
Alabama	II	3, 4	13, 14
Arkansas	I	3, 4	539, 540
California (no cotton production reported)	II	3, 4	661, 662
Florida	II	3	183
Georgia	II	3–5	269–271
Kentucky (in Report on Tennessee)	I	109	481
Louisiana	I	3, 4	105, 106
Mississippi	I	3, 4	205, 206
Missouri	I	3, 4	501, 502
North Carolina	II	3, 4	535, 536
South Carolina	II	3	459
Tennessee	I	3–8	375–380
Texas	I	3–6	661–664
Virginia	II	3	625
Counties in each region having highest cotton production in:			
Alabama	II	60	70
Arkansas	I	40	576
Florida	II	29	209
Georgia	II	55–57	321–323
Louisiana	I	33	135
Mississippi	I	72	274
North Carolina	II	21	553
Tennessee	I	41	413
Texas	I	50	708
Virginia	II	10	632
Counties in each state having highest cotton production (General Discussion).	I	5	17
Counties, product of lint per acre, by, in:			
Alabama	II	3, 4	13, 14
Arkansas	I	3, 4	539, 540
Florida	II	3	183
Georgia	II	3–5	269–271
Louisiana	I	3, 4	105, 106
Mississippi	I	3, 4	205, 206
Missouri	I	3	501
North Carolina	II	3, 4	535, 536
South Carolina	II	3	459
Tennessee	I	3–5	375–377
Texas	I	3–6	661–664
Virginia	II	3	625
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Alabama	II	156	166
Arkansas	I	106	642
Florida	II	71	251
Georgia	II	174	449
Indian territory	I	31	869
Louisiana	I	84	186
Mississippi	I	155	357
Missouri	I	28	526
North Carolina	II	77	609
South Carolina	II	61–66	517–522
Tennessee	I	104	476
Texas	I	162	830
Virginia	II	21	643
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Alabama	II	34–66, 112–141	44–76, 122–151
Arkansas	I	11, 27	547, 563
California	II	8	666
Georgia	II	13, 14, 126–128, 132	279, 280, 392–394, 398
Indian territory	I	8, 13	846, 851
Louisiana	I	10	112
Mississippi	I	12, 19	214, 221
North Carolina	II	11	543
South Carolina	II	10	466
Tennessee	I	22	394
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Arkansas	I	5, 6	541, 542
California	II	3, 4	661, 662
Florida	II	4	184
Georgia	II	6–8	272–274
Indian territory	I	3	841
Kentucky (in Report on Tennessee)	I	110	482
Louisiana	I	5, 6	107, 108
Mississippi	I	5, 6	207, 208
Missouri	I	4	502
North Carolina	II	5, 6	537, 538
South Carolina	II	4	460
Tennessee	I	5–8	377–380
Texas	I	7–10	665–668
Virginia	II	3	625
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Arkansas, area, elevation, and character, with sections of bluffs of.	I	9, 20, 55	545, 556, 591
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Alabama	II	154	164
Arkansas	I	99–101	635–637
California	II	75, 76	733, 734
Florida	II	68, 69	248, 249
Georgia	II	57, 58, 166–169	323, 324, 432–435
Indian territory	I	29, 30	867, 868
Louisiana	I	79, 80	181, 182
Mississippi	I	149–151	351–353
Missouri	I	26	524
North Carolina	II	74, 75	606, 607
South Carolina	II	26, 54–58	482, 510–514
Tennessee	I	42, 43, 99, 100	414, 415, 471, 472
Texas	I	155–157	813–815
Virginia	II	19, 20	641, 642
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Alabama	II	149–156	159–166
Arkansas	I	95–108	631–644
Florida	II	65–71	245–251
Georgia	II	159–176	425–442
Indian territory	I	27–31	865–869
Louisiana	I	75–85	177–187
Mississippi	I	145–155	347–357
Missouri	I	23–28	225–230
North Carolina	II	71–76	603–610
South Carolina	II	49–66	505–522
Tennessee	I	93–105	465–477
Texas	I	149–163	807–821
Virginia	II	17–21	639–643
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Alabama	II	153	163
Arkansas	I	97	633
California	II	75	733
Florida	II	67	247
Georgia	II	163	429
Indian territory	I	29	867
Louisiana	I	77	179
Mississippi	I	147	349
Missouri	I	25	523
North Carolina	II	73	605
South Carolina	II	51–54	507–510
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Florida	II	15–28	195–208
Georgia	II	25–53	291–319
Indian territory	I	10–17	848–855
Kentucky (in Report on Tennessee)	I	112	484
Louisiana	I	13–31	115–133
Mississippi	I	15–71	217–273
North Carolina	II	14–20	546–552
South Carolina	II	15–48	471–504
Tennessee	I	16–40	388–412
Texas	I	24–47	646–669
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Alabama	II	75–148	85–158
Arkansas	I	47–94	583–630
California	II	85–125	743–783
Florida	II	37–63	217–243
Georgia	II	67–158	333–424
Louisiana	I	41–73	143–175
Mississippi	I	85–143	287–345
Missouri	I	13–21	511–519
North Carolina	II	27–70	559–602
Tennessee	I	45–92	417–464
Texas	I	57–148	715–806
Virginia	II	11–15	633–637
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Florida	II	73–77	253–257
Georgia	II	177–184	443–450
Indian territory	I	33, 34	871, 872
Kentucky (in Report on Tennessee).			
Louisiana	I	87–93	189–195
Mississippi	I	157–164	359–366
Missouri	I	29–31	527–529
North Carolina	II	79–83	611–615
South Carolina	II	67–70	523–526
Tennessee	I	113–119	485–491
Texas	I	165–173	823–831
Virginia	II	23–25	645–647
Details, cultural and economic, of cotton production in:			
Alabama	II	149–156	159–166
Arkansas	I	95–108	631–644
Florida	II	65–71	245–251
Georgia	II	159–176	425–442
Indian territory	I	27–31	865–869

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North Carolina	II	71–78	603–610
South Carolina	II	49–66	505–522
Tennessee	I	93–105	465–477
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Arkansas	I	102, 103	638, 639
Florida	II	69, 70	249, 250
Georgia	II	170, 171	436, 437
Indian territory	I	30	868
Louisiana	I	81–83	183–185
Mississippi	I	152, 153	354, 355
Missouri	I	27	525
North Carolina	II	76	608
South Carolina	II	59, 60	515, 516
Tennessee	I	102, 103	474, 475
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Alabama	II	154	164
Arkansas	I	98, 99	634, 635
California	II	76	734
Florida	II	67, 68	247, 248
Georgia	II	57, 58, 165, 166	323, 324, 431, 432
Indian territory	I	29	867
Louisiana	I	78, 79	180, 181
Mississippi	I	148, 149	350, 351
Missouri	I	25, 26	523, 524
North Carolina	II	73, 74	605, 606
South Carolina	II	52–58	508–514
Tennessee	I	43, 98, 99	415, 470, 471
Texas	I	154, 155	812, 813
Virginia	II	19	641
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Alabama	II	14–56, 60	24–66, 70
Arkansas	I	39, 40	575, 576
Florida	II	29–31	209–211
Georgia	II	54–57	320–323
Indian territory	I	3, 21–25	841, 859–863
Kentucky (in Report on Tennessee)	I	111	483
Louisiana	I	32–35	134–137
Mississippi	I	72–76	274–278
Missouri	I	8, 9	501, 507
North Carolina	II	21, 22	553, 554
South Carolina	II	19–47	475–503
Tennessee	I	17, 25, 36, 38, 46	389, 397, 408, 410, 412
Texas	I	49, 50	707, 708
Virginia	II	10	632
Ditching, hillside, in:			
Alabama	II	78–148	88–158
Arkansas	I	49–94	585–630
Florida	II	38–60	218–240
Georgia	II	70–158	336–424
Indian territory	I	22–25	860–863
Louisiana	I	44–73	146–175
Mississippi	I	88–143	290–345
Missouri	I	16–18	514–516
North Carolina	II	30–64	562–596
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Mississippi	I	147	349
Missouri	I	25	523
North Carolina	II	73	605
South Carolina	II	53–54	507–510
Tennessee	I	97	469
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Louisiana	I	85	187
Mississippi	I	155	357
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Mississippi	I	145–155	347–357
Missouri	I	23–28	521–526
North Carolina	II	71–78	603–610
South Carolina	II	49–66	505–522
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Mississippi	I	154	856
Missouri	I	28	526
North Carolina	II	77	609
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Tennessee	I	104	476
Texas	I	161	819
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Mississippi	I	13	215
Missouri	I	8	506
North Carolina	II	12	544
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Florida	II	71	251
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Louisiana	I	85	187
Mississippi	I	155	357
Missouri	I	28	526
North Carolina	II	78	610
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Tennessee	I	105	477
Texas	I	163	821
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Alabama	II	156	166
Arkansas	I	106	642
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Georgia	II	174	440
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Louisiana	I	84	186
Mississippi	I	155	357
Missouri	I	28	526
North Carolina	II	77	609
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Louisiana	I	77	179
Mississippi	I	77, 78, 147	279, 280, 349
Missouri	I	25	523
North Carolina	II	73	605
South Carolina	II	51–54	507–510
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Alabama	II	153	163
Arkansas	I	41, 97, 98	577, 633, 634
Florida	II	67	247
Georgia	II	164	430
Indian territory	I	29	867
Louisiana	I	77	179
Mississippi	I	77, 78, 147	279, 280, 349
Missouri	I	25	523
North Carolina	II	73	605
South Carolina	II	51–54	507–510
Tennessee	I	42, 43, 97, 98	414, 415, 469, 470
Texas	I	118, 153, 154	776, 811, 812
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Indian territory	I	31	869
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Indian territory	I	9	847
Louisiana	I	11	113
Mississippi	I	13	215
Missouri	I	8	506
North Carolina	II	12	544
South Carolina	II	12, 13	468, 469
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Florida	II	71	251
Georgia	II	174	440
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Mississippi	I	154	356
Missouri	I	28	526
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Missouri	I	15–18	513–516
North Carolina	II	30–64	562–596
Tennessee	I	48–92	420–464
Texas	I	57–148	715–806
Virginia	II	12–14	634–636
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Arkansas	I	96	632
California	II	125	783
Florida	II	66	246
Georgia	II	160–162	426–428
Indian territory	I	28	866
Louisiana	I	76	176
Mississippi	I	146	348
Missouri	I	24	522
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Louisiana	I	1–6	103–108
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North Carolina	II	1–6	533–538
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Mississippi	I	149	351
Missouri	I	26	524
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Arkansas	I	99	635
California	II	75	733
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Indian territory	I	29	867
Louisiana	I	79	181
Mississippi	I	149	351
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North Carolina	II	76	608
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Arkansas	I	97–108	633–644
Florida	II	67–71	247–251
Georgia	II	163–176	429–442
Indian territory	I	29–31	867–869
Louisiana	I	77–85	179–187
Mississippi	I	147–155	349–357
Missouri	I	25–28	523–526
North Carolina	II	73–78	605–610
South Carolina	II	51–66	507–522
Tennessee	I	97–105	469–477
Texas	I	153–163	811–821
Virginia	II	19–21	641–643
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Alabama	II	5	165
Arkansas	I	104	640
Florida	II	70	250
Georgia	II	172	438
Indian territory	I	31	869
Louisiana	I	83	185
Mississippi	I	153	355
Missouri	I	27	525
North Carolina	II	77	609
South Carolina	II	62–65	518–521
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Tennessee	I	43, 103	415, 475
Texas	I	161	819
Virginia	II	21	643
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Alabama	II	9–14	19–24
Arkansas	I	9–12	545–548
California	II	7–18	665–676
Florida	II	7–15	187–195
Georgia	II	11–19	277–285
Indian territory	I	7–9	845–847
Kentucky (in Report on Tennessee)	I	111, 112	483, 484
Louisiana	I	7–11	109–113
Mississippi	I	9–13	211–215
Missouri	I	7, 8	505, 506
North Carolina	II	9–12	541–544
South Carolina	II	7–13	463–469
Tennessee	I	11–14	383–386
Texas	I	13–22	671–680
Virginia	II	7, 8	629, 630
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Alabama	II	69, 70	79, 80
Georgia	II	61	327
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Alabama	II	5, 6	15, 16
Florida	II	4	184
Georgia	II	6–8	272–274
Louisiana	I	5, 6	107, 108
Mississippi	I	5, 6	207, 208
North Carolina	II	5, 6	537, 538
South Carolina	II	4	460
Texas	I	7–10	665–668
Virginia	II	3	625
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Alabama	II	155, 156	165, 166
Arkansas	I	104–108	640–644
Florida	II	70, 71	250, 251
Georgia	II	172–176	438–442
Indian territory	I	31	869
Louisiana	I	83–85	185–187
Mississippi	I	78, 153–155	280, 355–357
Missouri	I	27, 28	525, 526
North Carolina	II	76–78	608–610
South Carolina	II	60–66	516–522
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Arkansas	I	5, 6	541, 542
California	II	3, 4	661, 662
Florida	II	4	184
Georgia	II	6–8	272–274
Indian territory	I	3	841
Kentucky (in Report on Tennessee)	I	110	482
Louisiana	I	5, 6	107, 108
Mississippi	I	5, 6	207, 208
Missouri	I	4	502
North Carolina	II	5, 6	537, 538
South Carolina	II	4	460
Tennessee	I	5–8	377–380
Texas	I	7–10	665–668
Virginia	II	3	625
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Alabama	II	3, 4	13, 14
Arkansas	I	3, 4	539, 540
California (no cotton production reported)	II	3, 4	661, 662
Florida	II	3	183
Georgia	II	3–5	269–271
Indian territory	I	3	841
Kentucky (in Report on Tennessee)	I	109	481
Louisiana	I	3, 4	105, 106
Mississippi	I	3, 4	205, 206
Missouri	I	3, 4	501, 502
North Carolina	II	3, 4	535, 536
South Carolina	II	3	459
Tennessee	I	3–8	375–380
Texas	I	3–6	661–664
Virginia	II	3	625
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Alabama	II	60	70
Arkansas	I	40	576
Florida	II	29	209
Georgia	II	55–57	321–323
Louisiana	I	33	135
Mississippi	I	72	274
North Carolina	II	21	553
Tennessee	I	41	413
Texas	I	50	708
Virginia	II	10	632
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Alabama	II	74	84
California	II	82	740
Georgia	II	66	332
Indian territory	I	17	855
Mississippi	I	80–83	282–285
Texas	I	55	713
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Arkansas	I	39, 40	575, 576
Florida	II	29–31	209–211
Georgia	II	54–57	320–323
Indian territory (cotton production not given)	I	3, 27–25	841, 859–863
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Mississippi	I	72–76	274–278
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North Carolina	II	21, 22	553, 554
Tennessee	I	17, 25, 36, 38, 40	389, 397, 408, 410, 412
Texas	I	49, 50	707, 708
Virginia	II	10	632
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Alabama	II	71–74	81–84
Arkansas	I	42–46	578–582
California	II	79–81	737–739
Florida	II	34	214
Georgia	II	64–66	330–332
Indian territory	I	17	855
Louisiana	I	40	142
Mississippi	I	80–83	282–285
North Carolina	II	25	557
South Carolina	II	48	504
Tennessee	I	44	416
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California	II	1–4	659–662
Florida	II	1–4	181–184
Georgia	II	1–8	267–274
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Louisiana	I	1–6	103–108
Mississippi	I	1–6	203–208
Missouri	I	1–4	499–502
North Carolina	II	1–6	531–538
South Carolina	II	1–4	457–460
Tennessee	I	1–8	373–380
Texas	I	1–10	659–668
Virginia	II	1–3	623–625
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Arkansas	I	10	546
California	II	9–11	667–669
Florida	II	7	187
Georgia	II	11, 20	277, 286
Indian territory	I	8	846
Louisiana	I	9	111
Mississippi	I	9	211
Missouri	I	7	505
North Carolina	II	10	542
South Carolina	II	16–46	472–502
Tennessee	I	12	384
Texas	I	15	673
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Arkansas	I	11	547
California	II	8, 33	666, 691
Florida	II	10–15	190–195
Georgia	II	14–16	280–282
Louisiana	I	10, 28	112, 130
Mississippi	I	12	214
North Carolina	II	11	513
South Carolina	II	10, 11	466, 467
Texas	I	21	679
Virginia	II	8	630
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Arkansas	I	100	636
California	II	75	633
Florida	II	68	248
Georgia	II	167	433
Indian territory	I	29	867
Louisiana	I	79, 80	181, 182
Mississippi	I	150	352
Missouri	I	26	524
North Carolina	II	74	606
South Carolina	II	55–58	511–514
Tennessee	I	99	471
Texas	I	156	814
Virginia	II	19	641

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Arkansas	I	102	638
Florida	II	69	249
Georgia	II	58, 170	324, 436
Indian territory	I	30	868
Louisiana	I	81	183
Mississippi	I	152	354
Missouri	I	27	525
North Carolina	II	75	607
South Carolina	II	58	514
Tennessee	I	102	474
Texas	I	158	816
Virginia	II	20	642
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Alabama	II	153	163
Arkansas	I	97	633
California	II	75	733
Florida	II	67	247
Georgia	II	163	429
Indian territory	I	29	867
Louisiana	I	77	179
Mississippi	I	147	349
Missouri	I	25	521
North Carolina	II	73	605
South Carolina	II	51–54	507–510
Tennessee	I	97	469
Texas	I	153	811
Virginia	II	19	641
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Alabama	II	153, 154	163, 164
Arkansas	I	97–99	633–635
Florida	II	67	247
Georgia	II	163–166	429–432
Indian territory	I	29	867
Louisiana	I	77–79	179–181
Mississippi	I	147–149	349–351
Missouri	I	25	523
North Carolina	II	73	605
South Carolina	II	51–54	507–510
Tennessee	I	97, 98	469, 470
Texas	I	153, 154	811, 812
Virginia	II	19	641
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Arkansas	I	3, 4	539, 540
California (no cotton production reported)	II	3, 4	661, 662
Florida	II	3	183
Georgia	II	3–5	269–271
Indian territory	I	3	841
Kentucky (in Report on Tennessee)	I	109	481
Louisiana	I	3, 4	105, 106
Mississippi	I	3, 4	205, 206
Missouri	I	3, 4	501, 502
North Carolina	II	3, 4	535, 536
South Carolina	II	3	459
Tennessee	I	3–8	375–380
Texas	I	3–6	661–664
Virginia	II	3	625
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Florida	II	76	256
Georgia	II	183	449
Indian territory	I	34	872
Louisiana	I	91, 92	193, 194
Mississippi	I	163	365
Missouri	I	30	528
North Carolina	II	82, 83	614, 615
South Carolina	II	70	536
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Missouri	I	8	506
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Arkansas	I	99	635
California	II	75	733
Florida	II	68	248
Georgia	II	167	433
Indian territory	I	29	867
Louisiana	I	79	181
Mississippi	I	149	351
Missouri	I	26	524
North Carolina	II	74	606
South Carolina	II	55–58	511–514
Tennessee	I	99	471
Texas	I	155	813
Virginia	II	19	641
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Alabama	II	11, 154	21, 164
Arkansas	I	101	637
Florida	II	68	248
Georgia	II	11, 20, 169	277, 286, 435
Indian territory	I	30	868
Louisiana	I	80	182
Mississippi	I	10, 151	212, 353
Missouri	I	26	524
North Carolina	II	75	607
South Carolina	II	26, 31, 37, 56, 58	482, 487, 493, 512, 514
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Alabama	II	154	164
Arkansas	I	99	635
California	II	75	733
Florida	II	69	249
Georgia	II	166	432
Indian territory	I	29	867
Louisiana	I	79	181
Mississippi	I	149	351
Missouri	I	26	424
North Carolina	II	74	606
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Arkansas	I	100	636
California	II	75	733
Florida	II	68	248
Georgia	II	167	433
Indian territory	I	29	867
Louisiana	I	79, 80	181, 182
Mississippi	I	150	352
Missouri	I	26	524
North Carolina	II	74	606
South Carolina	II	55–58	511–514
Tennessee	I	99	471
Texas	I	156	814
Virginia	II	19	641
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Alabama	II	154	164
Arkansas	I	100	636
California	II	75	733
Florida	II	68	248
Georgia	II	168	434
Indian territory	I	30	868
Louisiana	I	80	182
Mississippi	I	150	352
Missouri	I	26	524
North Carolina	II	74	606
South Carolina	II	55–58	511–514
Tennessee	I	100	472
Texas	I	156	814
Virginia	II	20	642
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Alabama	II	114, 154	124, 164
Arkansas	I	101	637
California	II	75	733
Florida	II	68	248
Georgia	II	168, 176	434, 442
Indian territory	I	30	868
Louisiana	I	80	182
Mississippi	I	151	353
Missouri	I	26	524
North Carolina	II	75	607
South Carolina	II	55–58	511–514
Tennessee	I	100	472
Texas	I	157	815
Virginia	II	20	642
Time when first cotton blooms appear in:			
Alabama	II	154	164
Arkansas	I	100	636
California	II	75	733
Florida	II	68	248
Georgia	II	168	434
Indian territory	I	30	868
Louisiana	I	80	182
Mississippi	I	150	352
Missouri	I	26	524
North Carolina	II	74	606
South Carolina	II	55–58	511–514
Tennessee	I	100	472
Texas	I	156	814
Virginia	II	20	642
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Mississippi	I	152	354
Missouri	I	26	525
North Carolina	II	75	607
South Carolina	II	58	514
Tennessee	I	102	474
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Georgia	II	70–158	330–424
Louisiana	I	44–73	146–175
Mississippi	I	88–143	290–345
Missouri	I	15–18	513–516
North Carolina	II	30–64	562–596
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Alabama	II	154	164
Arkansas	I	98, 99	634, 635
California	II	76	734
Florida	II	67, 68	247, 248
Georgia	II	57, 58, 165, 166	323, 324, 431, 432
Indian territory	I	29	867
Louisiana	I	78, 79	180, 181
Mississippi	I	148, 149	350, 351
Missouri	I	25, 26	523, 524
North Carolina	II	73, 74	605, 606
South Carolina	II	52–58	508–514
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Louisiana	I	84	186
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Indian territory	I	22–25	860–863
Louisiana	I	44–73	148–175
Mississippi	I	88–143	290–345
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Arkansas	I	99	635
California	II	75	733
Florida	II	68	248
Georgia	II	166	432
Indian territory	I	29	867
Louisiana	I	79	181
Mississippi	I	149	351
Missouri	I	26	524
North Carolina	II	74	606
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Georgia	II	170, 171	436, 437
Indian territory	I	30	868
Louisiana	I	81, 82	183, 184
Mississippi	I	152, 153	354, 355
Missouri	I	27	525
North Carolina	II	76	608
South Carolina	II	59	515
Tennessee	I	102	474
Texas	I	158, 159	816, 817
Virginia	II	20	642
Rotten limestone, analysis of, in:			
Mississippi	I	22	224
Texas	I	34	692
Rotten limestone, bluffs of, on Red river, Texas	I	115	773
Rotten limestone group (Cretaceous) in:			
Alabama	II	65, 118–132	75, 128–142
Alabama, nature of, and soils derived from	II	46, 47	56, 57
Arkansas	I	11	547
Indian territory	I	13	851
Llano Estacado, Texas	I	20	678
Mississippi	I	12	214
Texas, occurrence and composition of	I	34	692
Rotten limestone prairie region of Mississippi, area, length, width, and description of.	I	13, 14	215, 216
Rotten limestone, thickness, usefulness as a fertilizer, and analysis of, in Mississippi.	I	13, 21, 22	215, 223, 224
Round valley, California, extent and description of	II	122	780
Roup's and Jones' valley, Alabama, character and soils of.	II	97	107
Running to weed of the cotton-plant a peculiarity of the coast region in Georgia.	II	158	424
Running to weed of the cotton-plant in:			
Alabama	II	75–148	85–158
Arkansas	I	49–94	585–630
Florida	II	38–60	218–240
Georgia	II	67–158	333–424
Indian territory	I	22–25	860–863
Louisiana	I	44–73	146–175
Mississippi	I	88–143	290–345
Missouri	I	15–18	513–516
North Carolina	II	30–64	562–596
South Carolina	II	59, 60	515, 516
Tennessee	I	48–92	420–464
Texas	I	60–148	718–806
Virginia	II	12–14	634–636
Running to weed of the cotton-plant in Texas caused by destruction of bolls by the boll-worm.	I	114, 115, 121	772, 773, 779
Russell's valley, Alabama, description of lands of	II	108	118
Russian River valley, California, description and extent of.	II	56, 117	714, 775
Rust, cotton liable to, on hog-wallow and gypseous prairies in Mississippi.	I	51	253
Rust does not prevail on lands formed by intermixture of black prairie and red ridge soils in Mississippi.	I	16	218
Rust on cotton of black prairie lands in Mississippi, remarks on.	I	56	258
Rust or blight as affecting cotton in:			
Alabama	II	155	165
Arkansas	I	102, 103	638, 639
Florida	II	69, 70	249, 250
Georgia	II	171	437
Indian territory	I	30	868
Louisiana	I	28, 81–83	130, 183–185
Mississippi	I	16, 51, 56, 153	218, 253, 258, 355
Missouri	I	27	525
North Carolina	II	76	608
South Carolina	II	59, 60	515, 516
Tennessee	I	103	475
Texas	I	35, 53, 158–160	693, 716, 816–818
Virginia	II	20	642